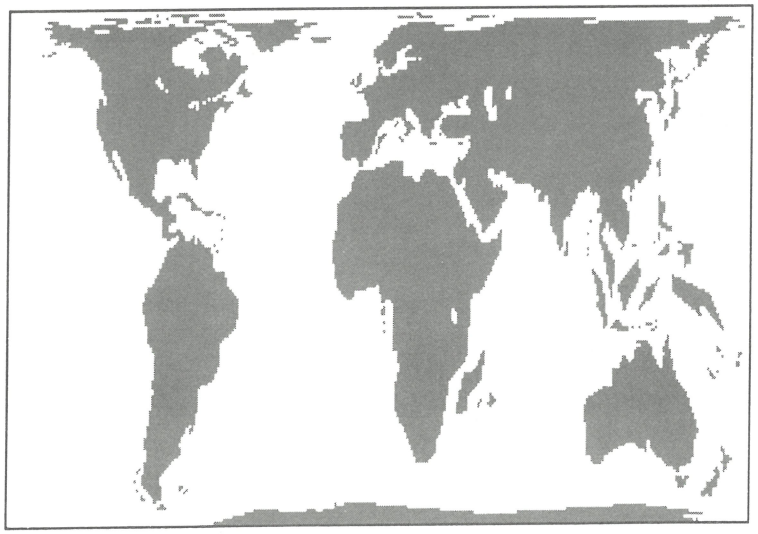
Coil

GEO WORLD

A Living Database™

Geography and Geology become Living Sciences.



Tom Snyder Productions®

Credits

GeoWorld™ was designed by Steven Fried and Thomas F.F. Snyder

Programmer: Steven Fried

Technical Support: Omar Khudari

Program Graphics: Patricia Hunter and Annette Donnelly

Senior Editor: Amy R. Brodesky

Assistant Editor: Anna P. Kent

Editorial Development: Michael Palmquist

Art Director: Peter H. Reynolds

Assistant Art Director: Annette Donnelly

Production Support: Annette Saucier

Project Manager: Richard D. Abrams

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GEOWORLD

A Living Data Base

Contents

This manual provides suggestions for using GeoWorld with your students. It includes technical directions, lesson plans, and reproducible student worksheets. We have also included teacher's charts which reveal several locations of each resource. We suggest that you read the manual and play GeoWorld before introducing it to your students. The step-by-step instructions on pages 10-23 will guide you through the program for the first time.

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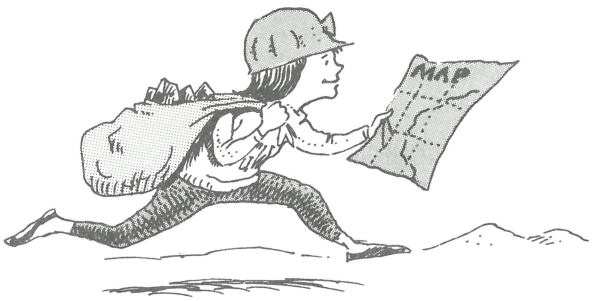
Welcome to GeoWorld, a new approach to using data bases in the classroom. It combines an accurate data base of 15 natural resources with an engaging simulation of geological exploration. Your students become researchers and geologists, searching the world for resources. They perform a variety of geological tests and make mining decisions. Through this hands-on experience, students learn about the distribution of resources in our interdependent world.

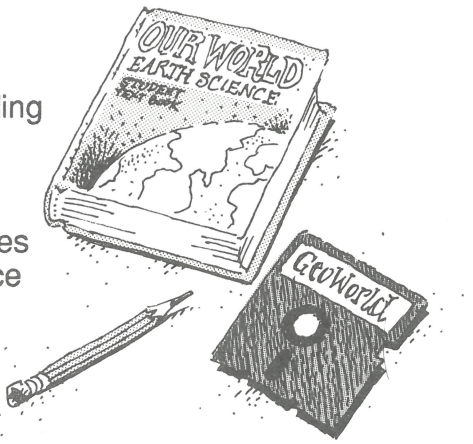
In designing GeoWorld, we have carefully built a model of the world that accurately represents the current distribution of resources. We have compiled this extensive data base from a number of geological reference books. Because the information is real and up-to-date, your students can use Geoworld as a research tool. It provides a powerful supplement to using atlases and encyclopedias.



GeoWorld can also be played as a game. Students are challenged to find as much of a resource as possible before spending all their money. This game format increases students' motivation to uncover the information in the data base and to devise exploration strategies.

GeoWorld is particularly powerful because it enables students to create their own data bases. They can easily transfer the information they have gathered on their geological expeditions to AppleWorks, a popular data base, word processor and spreadsheet program. This way, students can gain new insights into their topics by manipulating the data and performing calculations. They can also write and print out reports on their findings.

GeoWorld & Your Curriculum



GeoWorld fits easily into several subject areas, including earth science, social studies and geography. Earth science teachers can incorporate GeoWorld into lessons on many curricular topics, including minerals and rock types. The chart on pages 121-122 correlates the program with a variety of widely used earth science and geology textbooks.

Social studies teachers will also find many uses for GeoWorld. Students can gather a resource profile of the country or region currently being studied. The program serves as an excellent springboard for discussions about the world-wide distribution of resources and how that affects international relations. GeoWorld can also be incorporated into lessons on world geography and map-reading. In addition, it provides a good way to introduce students to the many uses of data bases in social studies and science.

Learning Objectives

GeoWorld is a versatile teaching tool which can be integrated into the earth science, social studies and geography curriculums. The simulation format actively involves students in the learning process. They read maps and charts, record and analyze information, and make decisions. Students have an opportunity to test out the information and concepts they have learned in class. In the course of the simulation, students apply their knowledge in new situations, reinforcing concepts and sparking discussions.

GeoWorld can help you teach many important topics, issues and skills,including:

Earth Science

- 15 major natural resources
- sedimentary, metamorphic and igneous rock deposits
- mineral deposits and mineral ores
- fossil fuels
- the process of geological exploration
- the relationship between resource locations and geological formations
- the uses of data bases in science

Social Studies

- the uneven distribution of resources around the world
- the importance of resources to the growth and development of countries
- the interdependency of countries
- the effects of limited resources on the political relationships between countries
- the uses of data bases in social studies

Geography

- world geography
- the locations of different resources
- map-reading skills
- latitude and longitude

Critical-Thinking and Problem-Solving Skills:

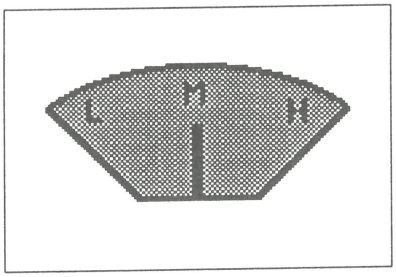
- interpreting information from maps, meters, charts and diagrams
- recording and organizing information
- comparing and contrasting information
- making predictions based on data
- considering alternatives, weighing consequences, and evaluating risks
- developing research strategies
- making collaborative decisions

How the Simulation Works -- An Overview

Resources	
Aluminum	Manganese
Chromium	Nickel
Coal	Oil
Cobalt	Silver
Copper	Tin
Gold	Uranium
Iron	Zinc
Lead	

In GeoWorld, students assume the role of a leader of a geological expedition. They must make a series of important decisions -- where to explore, what tests to perform and where to mine. The computer plays the role of a team of researchers and geologists which carries out the students' decisions. At their command, it performs geological tests, mines for resources and presents the results.

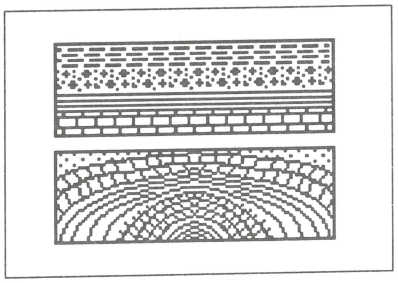
Students may search the world for 15 major resources: 13 minerals and two fossil fuels. However, they can search for only one at a time. Students begin by selecting an area of the world to explore. They can perform three geological tests to help them decide which locations are most likely to contain their resource. The results of each kind of test are presented differently -- as meters, charts or diagrams -- to help build students' skills. By interpreting these results, students can determine which areas should be further examined. When they have gathered strong evidence of a resource, they are able to test their research by mining. GeoWorld keeps a record of the students' findings which can be displayed on the screen or printed out.



Geochemical Test Meter

SEDIMENTARY ROCK Marine Fossils	SEDIMENTARY ROCK Bauxite
IGNEOUS ROCK Galena Chromite	SEDIMENTARY ROCK Gold

Core Sample Chart



Diagrams of Underground Cross Sections

Mining Record

Resource: Gold
Amount Found: 24,600,000 oz.
% World's Known Reserves: 55.7

Mining Record

How the Simulation Works -- An Overview

Geological Tests

The three geological tests are described below:

The Geochemical Test looks for evidence of the resource in the soil, water and air. By reading the resource-measuring meters, students can determine which areas should be further tested.

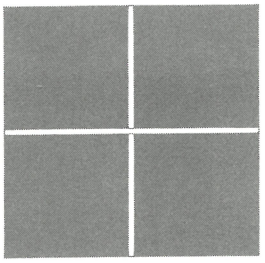
The Core Sample helps students find out what types of rocks and mineral ores are below the surface. The program drills a core into the earth and brings up sample rock and mineral deposits. These samples are grouped by deposit type (sedimentary, igneous and metamorphic) and are presented in order of importance to the selected resource.

Diagrams enable students to see the way an area looks underground. These pictures of underground cross sections show how the rocks are arranged. Students can use the Resource Information Sheets to determine whether the deposit formations are likely to yield their resource.

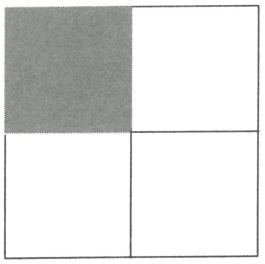
Mining

Students choose an area, and the program mines it for their resource. The results are immediately presented on the screen. Also, GeoWorld keeps a total of the amounts which have been mined, and it calculates the percentage of the world's known reserves of the resource.

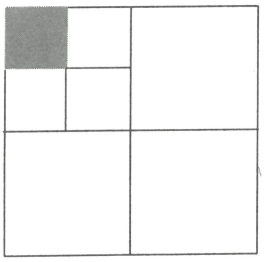
Each test covers an increasingly smaller area.



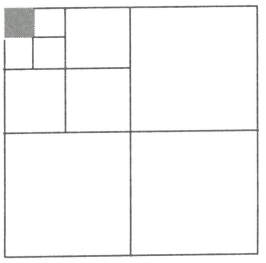
The Geochemical Test covers the largest area.



The Core Sample covers an area one-fourth the size of the geochemical test.



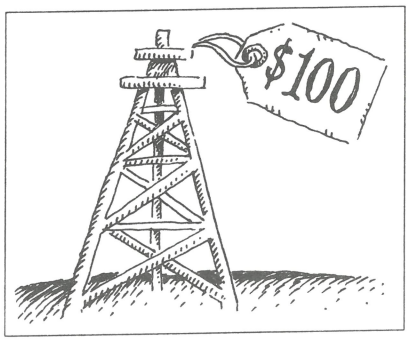
Diagrams cover an area one-fourth the size of the core sample.



Mining can only be preformed on an area which is one-fourth the size of that covered by the diagrams.

Different Ways to Play

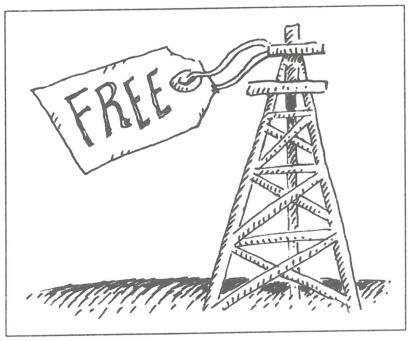
This section describes the two basic versions of GeoWorld.



Game Version

Teams, pairs or individual students assume the role of geologists and are given $5,000 to search for a resource. They are challenged to find as much of the resource as possible before running out of money. They can spend this money on three different geological tests and on mining for their resource. The only way students will be able to get more money is by finding 10% of the world's known reserves of their resource; each time they find 10%, they receive a bonus of $1,000. GeoWorld keeps a record of the total amount of the resource students have found.

This game format challenges students to develop exploration strategies for finding resources without spending a lot of money. It motivates them to apply the knowledge they've learned in class and to investigate other sources of information, such as atlases and reference books.



Research Version

GeoWorld can also be used as a tool for researching the distribution of resources. In contrast to the game version, there are no costs for performing geological tests or mining. This enables students to explore as much as they wish to gather information for research projects or reports. They can transfer their findings to AppleWorks, which is a combined data base, word processor and spreadsheet program. This way, students can easily create their own data bases to use for further research and analysis, and then use the word processor to write and print out reports.

Different Classroom Settings

Depending on the number of computers that you have available, there are many ways to use GeoWorld. This section provides suggestions for different classroom settings.

Computer Lab

If you have access to a computer lab, students can play GeoWorld individually, in pairs or in small groups. The lab setting provides a valuable opportunity for students to learn at their own pace. This setting is also conducive to playing the game version because all the students can actively participate in the race to find resources. Students may also want to spend a lab period doing research with GeoWorld or using AppleWorks to analyze their data.

One-Computer Classroom

GeoWorld may be used as a visual aid for classroom demonstrations. Alternatively, you may want to play GeoWorld with the class as a group. You, as teacher, control the keyboard and lead the class through the exploration process. In both cases, you can focus on the aspects of GeoWorld which fit into your curriculum. For instance, you may want to introduce students to the natural resources of a country or region. Or, you may want to emphasize specific minerals and deposit types. If you prefer to have students work individually or in pairs on GeoWorld, set up a schedule of turns at the computer or provide sign-up sheets.

Step-by-Step Directions for Playing the Game Version

In this sample game, you will be searching for oil. You will start out with $5,000. Your goal is to find as much oil as you can before you run out of money. Everything costs money -- moving around the world, performing geological tests and mining. The cost of each action is listed below:

Geochemical Test	$ 5
Core Sample	$ 10
Diagrams	$ 20
Mine	$100

The cost of moving around the world increases with the distance you move. This cost ranges from $100 to $1,200.

The only way you can get more money is to find 10% of the world's known reserves of oil. You will receive a $1,000 bonus for every 10% that you find. The program will tell you when you have earned a bonus.

The game will end when you have less than $100 because you will not be able to afford to mine. You need to mine in order to make more money. You will receive the message: *Game over. You don't have enough money to pay for mining.*

1 Setting Up the Game Version

A. Put the disk into drive 1 with the *Start-Up* side up and close the drive door.

B. Turn on your monitor and computer.

C. The program will load into the computer and the title screen will appear. Press **any key** to move on to the next screen.

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D. Now you will get a continuous tour of the world. Press **any key** when you are ready to move on to the next screen.

***Tip:** This tour of the world will not stop by itself. Press **any key** to stop it.*

E. Next, press **1** to play a new game.

F. Press **1** to play a standard game.

2 Playing

The following chart lists the keys you can use:

To:	Press:
Move through a menu	Spacebar
Select an option	Return
Correct a mistake	Esc
Move a highlighted box up	↑ (I on the Apple II+)
Move a highlighted box down	↓ (M on the II+)
Move a highlighted box to the left	← (J on the II+)
Move a highlighted box to the right	→ (K on the II+)

A. Now GeoWorld will display a list of the 15 resources for which you can search and mine. You can only search for *one* resource at a time. Use the **Spacebar** to move through the alphabetical list of resources. Press **Return** to select *Oil.*

***Tip:** Press **Esc** if you have made a mistake. You will now have another chance to select a mineral.*

B. The next screen shows which resource you have chosen: *Oil is selected.*

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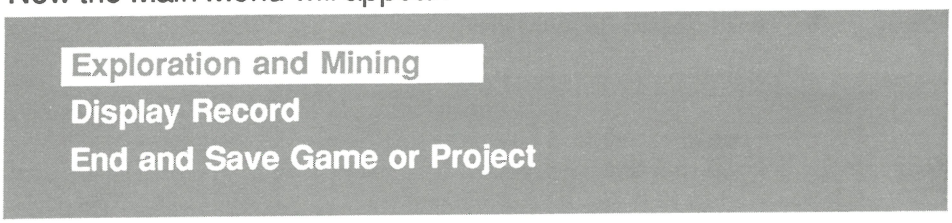
C. Now the Main Menu will appear:



Press **Return** to select *Exploration and Mining*.

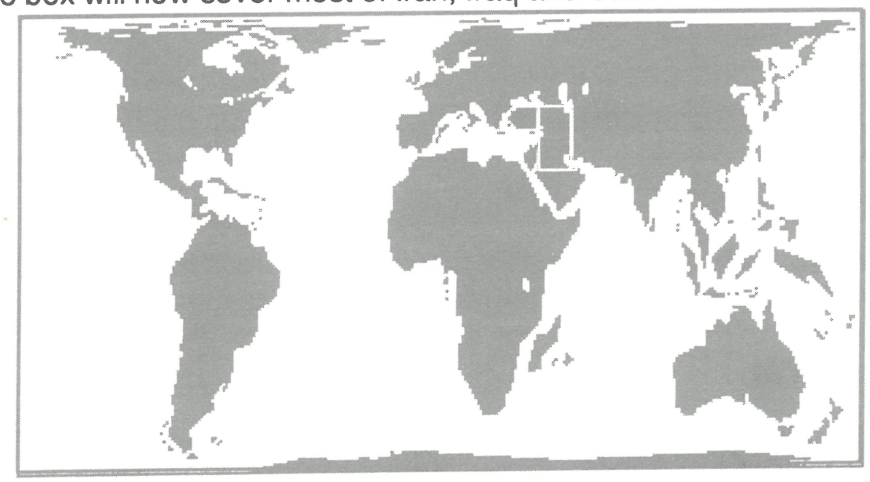
D. Remove the disk from the disk drive, flip it over, and insert it with the *Exploration* side up. Press **any key** to continue.

3 Selecting an Area of the World

Now you will see a full-screen map of the world. The first step in the exploration process is selecting the area you want to explore by moving the highlighted box. This box encloses 20° by 20° sectors of the world. Your starting position is latitude 20°N and longitude 0°E.

A. Let's start our search for oil in the Middle East.

Press the → key 2 times and then the ↑ key 1 time.
The box will now cover most of Iran, Iraq and Saudi Arabia.



Latitude 40°N Longitude 40°E

This is the latitude and longitude of the top left corner of the sector.

Move to new area
Cash = $5,000 Move would cost $300

B. Press **Return** to take a closer look at the area. The cost of moving is subtracted from your cash.

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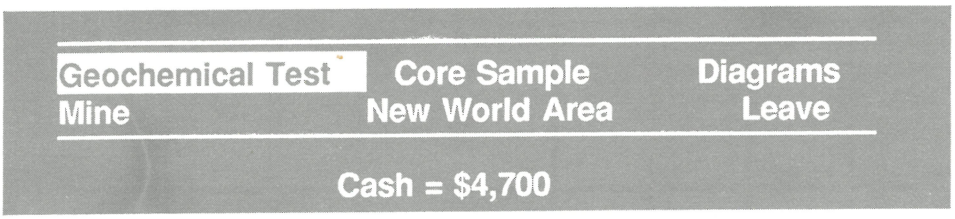
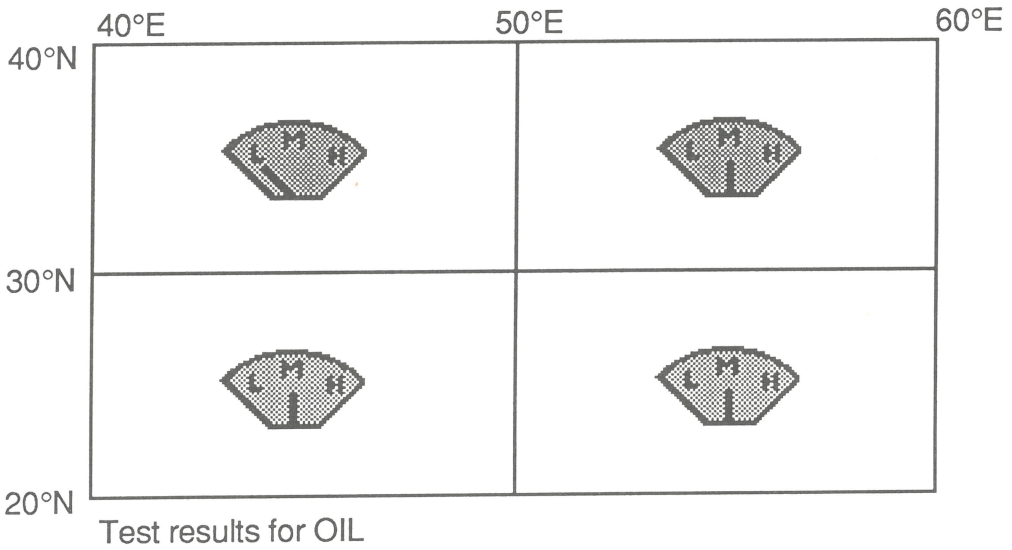
4 Performing a Geochemical Test

Now you can perform your first geological test for oil.

A. Press **Return** to select ***Geochemical Test***. It will test the area for the presence of oil. This test costs $5.



B. The area is divided into four parts. Each quarter is tested for evidence of oil. The resource-measuring meters show the test results. Evidence of oil is measured on a scale of Low, Medium and High (**L**, **M** and **H**).



Test results for OIL

As a meter scans its area, the pointer shows the corresponding level of oil in that area. A meter will not give an overall reading for an area, but will give separate readings for each part of the area. The pointers are constantly moving, so watch each one carefully.

You will have plenty of time to read the meters because the test will keep repeating until you tell it to stop. The computer will make a beeping noise to indicate that the test has ended and will now be repeated.

Tip: *If you are playing in small groups, each person can be responsible for reading a different meter.*

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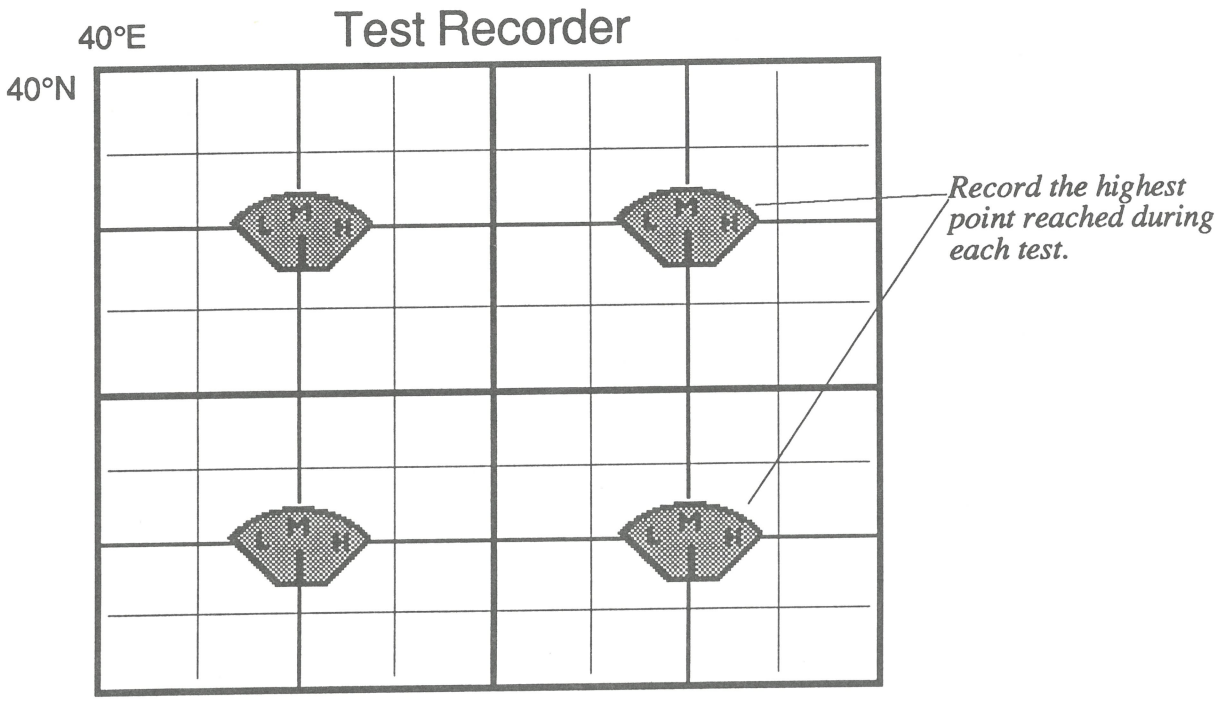
C. In this case, all four meters point to **medium** at least once during the test. Record the information on your Test Recorder.

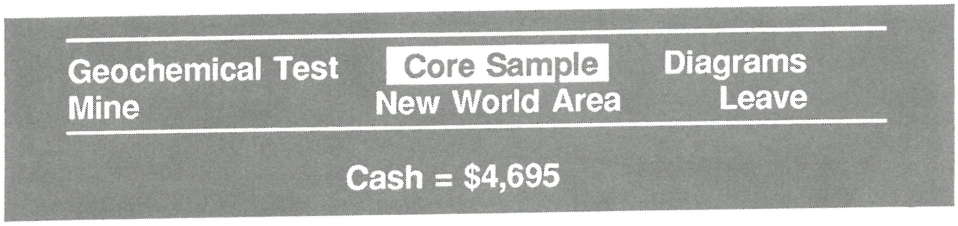


D. Press **Return** when you are ready to move on.

5 Performing a Core Sample

A. Now you can perform another geological test to get more information on a smaller part of this area (10° by 10°).

Use the **Spacebar** to move the cursor to ***Core Sample*** and press **Return**. Core samples cost $10.



Tip: *If you did not find strong evidence of oil, it would not make sense to continue testing this area. You could choose another area of the world to explore by selecting "New World Area."*

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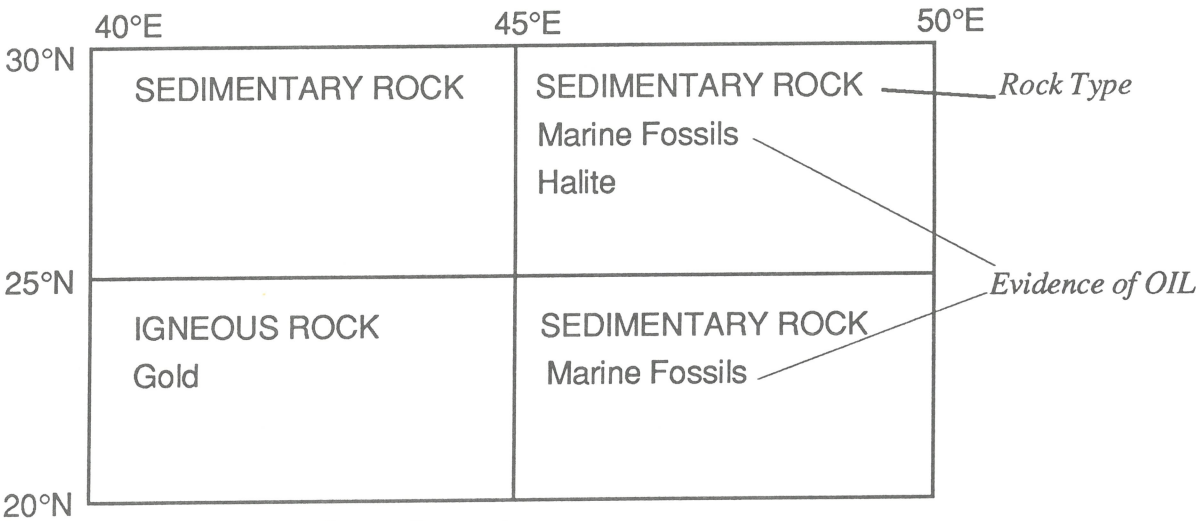
B. Next, you must decide where to perform the core sample. Since all four parts showed evidence of oil, it doesn't matter which one you test first.

Press the ⊕ key to move the flashing box to the lower left quarter. The latitude is 30°N and the longitude is 40°E -- this area covers the central part of Saudi Arabia.

C. Press **Return** to perform a core sample on that area. The area is divided into four parts and a core sample is performed on each. This test drills a core into the earth's crust and brings up samples of mineral ores and rocks. The program groups the samples by deposit type -- sedimentary, metamorphic and igneous. It then lists them in order of importance to your chosen resource.

The screen will show the results of the core sample:



Results of the Core Sample

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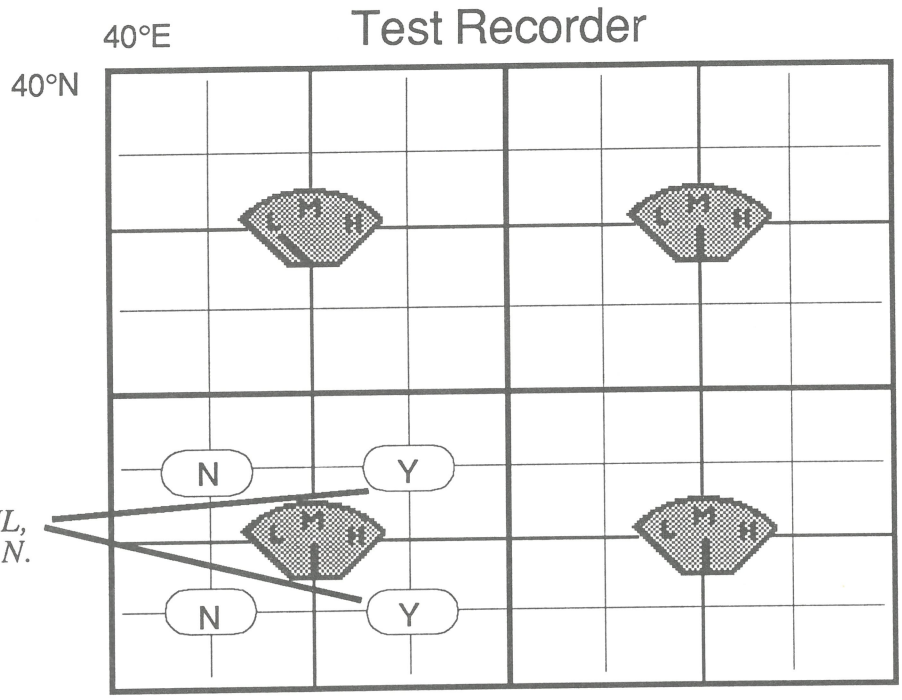
D. Use your Resource Information Sheet (page 103) to find out which samples provide evidence of oil. It is likely that you will find oil in the two areas which contain **marine fossils**. Record this information on your Test Recorder.



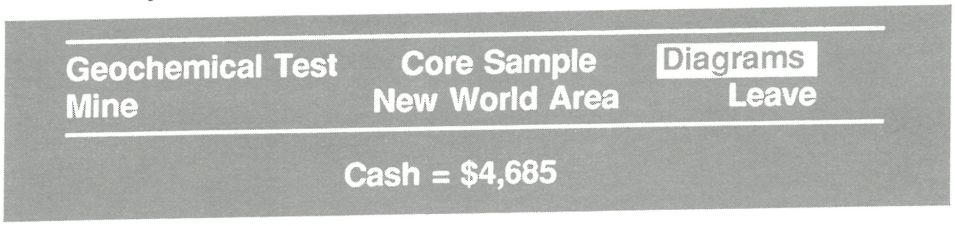
E. Press **Return** to leave.

Tip: *If the core sample did not present evidence of oil in this quarter, you could perform the test on another quarter. Select "Core Sample," press* **Return** *and then move to another quarter. Or, you could select "New World Area" in order to return to the full-screen map and choose a new world area to explore.*

6 Examining Underground Diagrams

This test prepares pictures of the way an area looks underground. The diagrams show how the rocks are arranged.

A. Use the **Spacebar** to move the cursor to *Diagrams* and then press **Return**.



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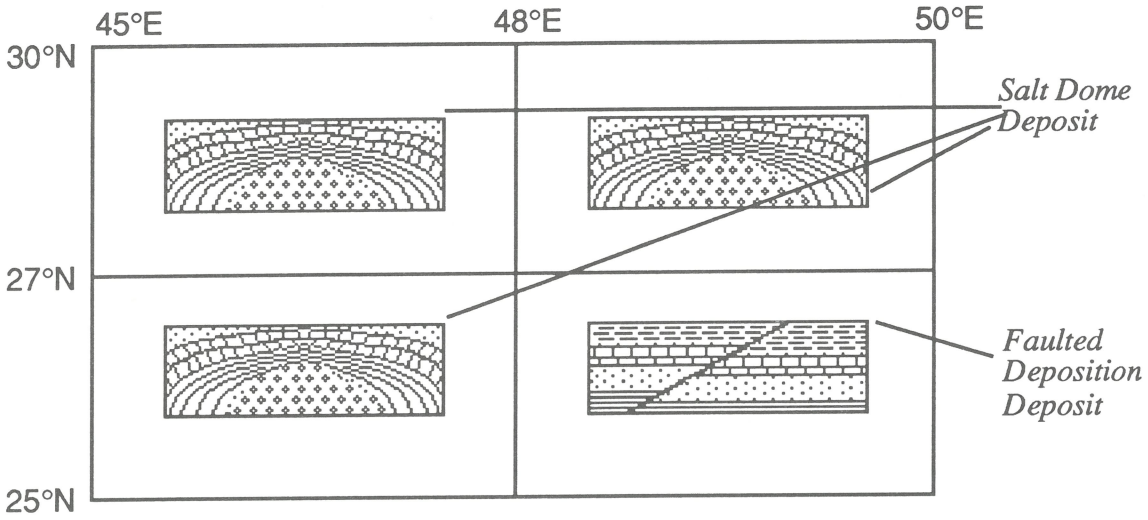
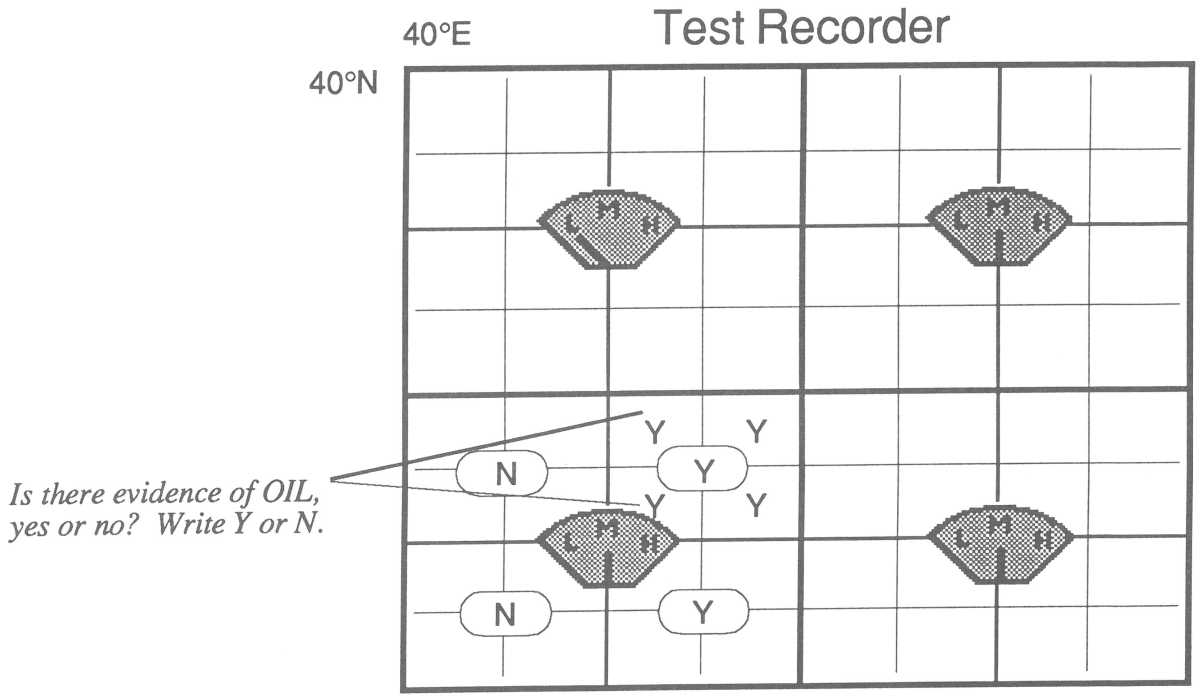
B. Use the ⊡ key to move the flashing box to the upper right quarter -- latitude 30°N and longitude 45°E. Press **Return** to get diagrams of that area. The $20 cost of the diagrams is subtracted from your cash.



Diagrams of Underground Cross Sections

C. Use your Resource Information Sheet to find out which diagrams show evidence of oil. The Salt Dome deposits found in three of the quarters are good indications of oil. This type of deposit formation traps oil and holds it. The Faulted Deposition deposit in the lower right corner is also likely to contain oil. Write down this information on your Test Recorder.



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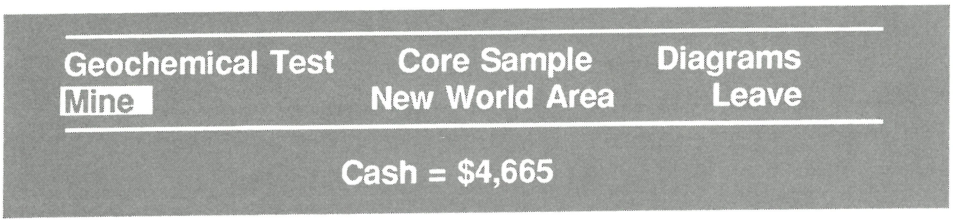
D. Press **Return** when you are ready to leave.

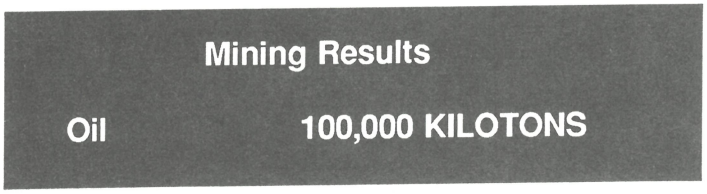
Tip: *In order to help you find resources quickly without wasting money, we suggest that you perform the geological tests in the order described -- geochemical test, core sample and diagrams. The program, however, will not force you to do this. You can choose to mine without doing any tests, or you can start your research with a core sample. But, you cannot get diagrams until you perform a core sample on the area. Performing a core sample provides the information needed to make a diagram.*

7 Mining

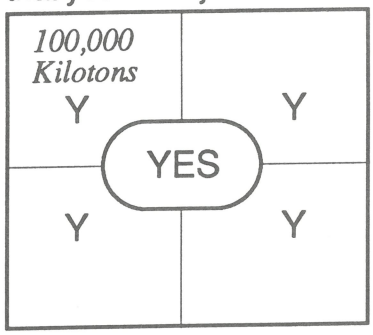
A. Since you have found strong evidence of oil, you are ready to mine. Use the **Spacebar** to move to ***Mine*** and press **Return**.



B. Let's mine all four quarters. Press **Return** to mine the upper left block -- latitude 30°N and longitude 45°E. Mining costs $100.



C. Write this information on your Test Recorder or on the Resource Information Sheet. Press **Return** to leave. You will see a mining symbol on the block that you have just mined.



Place	Amount
30°N 45°E	*100,000*

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D. Press **Return** to select ***Mine*** again. Press the → key to move the flashing box to the upper right corner (lat. 30°N., long. 48°E.) and press **Return**. The area will be mined and a screen will post the amount of oil you found this time:

Mining Results	
Oil	139,000 KILOTONS

Note: The mining results will tell you how much was found in this particular mine -- not the total amount obtained from all your mines.

E. Let's mine the third block. Press **Return** to select *Mine*. Press the ← key once and the ↓ key once to move the box to the lower left corner. Press **Return** to mine the block:

Mining Results	
Oil	130,000 KILOTONS

F. **Congratulations!!** You have mined over 10% of the world's known reserves of oil. You will be rewarded with a $1,000 bonus.

This is the only way you can get more money. Each time you find 10% of the world's known reserves of oil, you will receive a $1,000 bonus.

G. Now let's mine the last quadrant. Press **Return** to select ***Mine***. Press the → key once to move the box to the lower right quadrant (lat. 27°N., long. 48° E.). Press **Return** to mine.

Mining Results	
Oil	130,000 KILOTONS

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8 Seeing Your Record

If you want to find out the total amount of oil you have mined, you can ask GeoWorld to display a record on the screen.

A. Use the **Spacebar** to select *Leave* and press **Return**.

B. Now you will see the Main Menu. Select *Display Record* with the **Spacebar** and press **Return**. The next screen will look like this:

Resource: Oil
Total Amount Found: 499,000 Kilotons
% of the World's Known Reserves: 14.9%

C. Press **Return** to go back to the Main Menu.

D. If you want to continue looking for oil, select *Exploration and Mining*. You will return to the area which you were previously exploring. You can continue exploring this location, or you can select a new world area.

9 Ending the Game

A. The game will end when you have less than $100 because you will not have enough money to mine. Mining is the only way you can make more money. You will receive the message:

Game over. You don't have enough money to pay for mining.

B. If you want to stop playing, select *Leave* and you will return to the Main Menu. Select *End and Save Game or Project.* Continue by following the directions on page 22.

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Directions for Using the Research Version

This section provides directions for using GeoWorld as a research tool. The research version works the same way as the game version except that actions do not cost money. You can perform as many geological tests as you wish and mine repeatedly. This enables you to gather as much information as you need for research projects and reports. In addition, you can save your research at any time and resume working on it when you wish. In this sample project, you will be searching for oil.

Setting up the Research Version

A. Put the disk into drive 1 with the *Start-Up* side up and close the drive door.

B. Turn on your monitor and computer.

C. The program will load into the computer and the title screen will appear. Press **any key** to move on to the next screen.

D. Now you will get a continuous tour of the world. Press **any key** when you are ready to move on to the next screen.

***Tip:** This tour of the world will not stop by itself. You can stop it by pressing **any key**.*

E. Press **2** to start a research project.

F. Continue by following the directions for playing the game version on pages 11-20. Ignore all references to money.

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Saving A Game or Research Project

You can save your work at any time and continue it when you wish.

A. When you are ready to quit, select *Leave*. You will return to the Main Menu. Use the **Spacebar** to select *End and Save Game or Project* and press **Return**.

B. You will be asked, *Do you want to save your work?*

Type **Y** if you want to save your work or **N** if you don't.

C. Then you will be asked to type in a name for your game or project. The name can be up to 10 letters long. You can use spaces but no punctuation marks. For example, you could name your search: *Sample Oil*

***Tip:** Use the ⌫ key or the **delete** key to make corrections.*

D. Press **Return**.

E. Then you will be asked if you want a history file. By saving your game as a history file, you will be able to both print out a report of your findings immediately and transfer the information to AppleWorks. You can use the AppleWorks data base program to manipulate your data, or you can use the word processor program to write and print out reports. If you have access to a printer, we suggest that you print out a report to see what it looks like.

To print a report, type **Y** and skip to the next section, page 23.
To use AppleWorks, type **Y** and follow the directions on page 61-85.

If you don't want to choose either of these two options, type **N**.

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Printing a Report of Your Findings

A GeoWorld report contains information on the locations where you found a resource. It includes each location's latitude and longitude, the size of each deposit, and the percentage of the world's known reserves of that resource.

A. Save your game or research project by following the directions in the previous section.

B. Type **Y** to create a history file.

C. Next, press **1** to create a word processor file.

***Tip:** Press **Esc** if you have made a mistake.*

D. You will receive the message: *Putting group history in GWDATA.TXT.*

E. Type **Y** if you want to print the file right now. Check to make sure your printer is properly attached and turned on.

F. GeoWorld will ask which slot your printer card is in. Type in the slot number. If you are not sure, type **1**.

G. The printer will now print out a report of your findings. This is a sample report for oil:

MINING RECORD FOR TIM S.
RESOURCE MINED WAS OIL
THE UNIT OF AMOUNT IS IN KILOTONS

LAT	LONG	AMOUNT	%	ENV
30N	45E	100000	3.0	SED
30N	48E	139000	4.1	SED
27N	45E	130000	3.9	SED
27N	48E	130000	3.9	SED
TOTAL IS		499000	14.9	

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Preparing to Use GeoWorld

This section presents an overview of how to use GeoWorld in your classroom or computer lab.

Preparing Yourself

Before you introduce GeoWorld to your students, we encourage you to read this manual and play the simulation yourself. The directions on pages 10-23, will guide you through your first game or research project. Going through the program yourself will help you figure out how to incorporate it into your curriculum. You will need to decide whether to use the game or research version with your class. The game version increases students' motivation to find resources, whereas the research version is better suited for more extensive exploration and research. Suggestions for using both versions are provided on pages 29-30, 34-35, and in the lesson plans.

Preparing Your Class

GeoWorld is designed to fit easily into an earth science, social studies or geography curriculum, so you may find that little additional preparation is needed. We have included sample introductory discussion questions and activities.

The Student's Introduction Sheets (pp. 88-89) provide an overview of the simulation and explain each of the geological tests. We suggest that you make copies for your students to read. Alternatively, you may want to read the introduction aloud to the whole class. Discuss the simulation with your students to make sure that they understand how it works.

Note: You can refer to the teacher's charts of Resource Locations, pages 119-120 for some locations of the resource you have chosen.

A good way to prepare students for using GeoWorld is to demonstrate the program to the class. You may want to go through the sample search for oil on pages 10-19. Before starting a demonstration, distribute copies of the Resource Information Sheet for the resource you have selected. Also, you may want to ask students to do additional background research on the resource.

Set up a computer so the class can see the monitor. If available, use a large-screen TV or additional monitors for easier viewing. Load GeoWorld into the computer and select the appropriate version -- game or research. Go through each step in the exploration process with the class. In addition, you may want to distribute copies of the Test Recorder (page 92) and demonstrate how to record information on it.

Introductory Questions and Activities

General Questions

This section provides general discussion questions in the areas of earth science and social studies.

1. What is a resource?
2. What is a mineral? What is a rock? How do they differ?
3. Discuss this analogy: A mineral is to a rock as a tree is to a forest.
4. How are minerals formed? How are they classified?
5. If you dug a hole in your backyard, what kinds of minerals do you think you would find?
6. What are the three basic rock types? How is each formed?
7. Throughout history, people have searched the world for resources. What effects has this had?
8. How does the presence of different resources affect a country's development?
9. How does the presence of different resources affect a country's relations with other countries?
10. What is a data base? How are data bases created? How are they used?

Specific Questions

This section provides questions about the resource or resources for which students will be searching.

Earth Science

1. How is this resource formed?
2. Is this resource a mineral? Why or why not?
3. When was the resource first discovered? How was it discovered?
4. How is this resource used?
5. Examine a sample deposit of the resource. What are its properties -- color, luster, texture, density, streak, hardness, cleavage and magnetism?

Social Studies

1. How is this resource used?
2. What important inventions use this resource?
3. How valuable is this resource to a modern industrial society?
4. How has the resource been used in the past?

Introductory Questions and Activities, cont.

5. Is this resource currently in the news? If so, why?
6. Research the area of the world you plan to explore for this resource. What are its characteristics (population, government, economy etc.)?

Activities

1. Review the vocabulary list on pages 115-116.
2. Make a chart of common rocks and minerals, their uses and their properties -- color, luster, texture, density, streak, hardness, cleavage and magnetism.
3. Examine a sample of the resource for which you will be searching. Identify its properties -- color, luster, texture, density, streak, hardness, cleavage and magnetism. Repeat this exercise with another resource and compare the two.
4. Gather articles on geology, mining and resources from newspapers and magazines.
5. Review map-reading skills, such as using latitude and longitude.
6. Compare the Peter's Projection to other map projections.
7. Examine a topographic map for the area of the world you plan to explore. What are the area's major geological features?
8. Discuss the nature of mineral exploration and mining.
9. Research real-world uses of data bases.

Setting Up the Computer Lab or Classroom

Computer Lab

If you have access to a computer lab, students may work individually, in pairs or in small groups on GeoWorld. If you do not have enough disks for your students, you can use the *Start-Up* side to load GeoWorld into each computer. After the program has been loaded, you can replace the original disk with a copy of the *Exploration* side, and then load GeoWorld into another computer. (See page 51 for directions.)

You will need to make a copy of the *Exploration* side for each student, pair or group that will be working at a computer. You can use any Apple copy program to make the copies. Or, you may want to purchase a lab pack which includes ten GeoWorld disks.

Note: The Start-Up side of the disk is required to start GeoWorld and cannot be copied. You can, however, make as many copies of the Exploration side as you need. This way, many students can play at the same time and save their own games.

One-Computer Classroom

You may want to use GeoWorld for classroom demonstrations or to play with the class as a group. In both cases, the monitor needs to be visible to the whole class. We suggest using a larger screen or additional monitors for easier viewing.

Alternatively, you may want students to use GeoWorld individually, in pairs or in small groups. To facilitate classroom management, set up a schedule of turns at the computer or provide sign-up sheets. It's not necessary for an entire group to use the computer at the same time. Group members can take turns working on GeoWorld by continuing a saved game or project. You may want to make copies of the *Exploration* side of the disk so students can save their work.

Student's Tools

The Student Reproducible Materials section provides worksheets for students to use when they play GeoWorld. These materials help students interpret and record information. Each student, pair or team will need copies of the following worksheets:

Resource Information Sheets. These sheets help students interpret the geological tests. There is a sheet for each of the 15 resources. Copy only the ones which are appropriate to your search.

Test Recorders. These worksheets help students record information from the geological tests. The number of copies each student will need depends on how many areas he or she searches. We suggest that you start out by giving each student three copies and have extra copies available.

World Maps. This manual includes two maps: a Sector map and a Political map. The first divides the world into 79 sectors (20° by 20°). These sectors are numbered to make it easy for students to refer to different locations. You can use the sector numbers to assign students areas of the world to explore. The second map shows the borders of countries and identifies them by name. Students can use these maps to help them decide where to mine and to figure out which countries contain the resources they have found.

Reference Card. This handout summarizes the different actions students can take.

Optional Materials

Game Sheet. This sheet is for the game version only. It lists the rules of the game, the cost of each action and provides a chart for recording results.

Resource Chart and Deposit Type Chart. The Resource Chart lists the ores and deposit types which provide evidence of each resource. The Deposit Type Chart shows diagrams of sixteen deposit types. In order to interpret the geological tests, students will need copies of both charts. These charts may be used instead of the Resource Information Sheets. They are particularly useful when students are searching for two or more resources.

How Much Time Will You Need?

The amount of time it takes to play GeoWorld depends on the way you use it. Exploration and research can take place in as little time as one class period or can be extended throughout the school year. Students can save their games or research projects at any time and continue whenever they wish. This gives you the choice of playing on consecutive days or setting aside one class period a week for using GeoWorld.

Playing Suggestions

After the computers are set up and the materials are distributed, your students will be ready to play. GeoWorld is easy to use, so your students will quickly become involved in a search for resources. This section provides general playing suggestions. Step-by-step directions for the game and research versions are provided on pages 10-23.

General Tips

1. Begin by introducing the simulation. Explain each of the different actions.
2. Choose a resource or resources for which you want students to search. Or, allow students to choose their own.
3. You may want to suggest that students use outside materials to help them find their resources.
4. In order to provide students with suggestions for finding resources, you may want to use the Teacher's Charts (pp. 119-120) which list some resource locations.
5. Leave about ten minutes at the end of each session to discuss the search, answer questions and print out reports on student findings.
6. If you want to continue a game or research project, make sure students save their work. To help you keep track of the files, we suggest that students name their files with their own names.

Tips for the Game Version

1. Before you play, hand out copies of the Game Sheet. Discuss the goals and rules of the game and the costs of each action. Point out that the game will end when students have less than $100 left.

2. We suggest that you set a time limit for the game. For example, students can compete to find the largest amount of a resource in one class period.

3. Decide whether you want to allow students to use outside materials, such as atlases and encyclopedias, to help them locate resources.

4. If students are competing with each other, you will need to pick the winner. The program keeps a record of the total amount of a resource each student has found. Ask students either to print out their records or to write the information on a sheet of paper. Then, you will be able to compare the records and select the winner.

Record Keeping

GeoWorld keeps a record of students' work. It reports the amount of the resource found, both as an actual amount and as a percentage of the world's known reserves of that resource. You can ask the program to display the information on the screen or print it out. A printed report provides more information, including the latitude, longitude and deposit types of successful mines. You may want to use the chart on page 118 to keep a record of students' progress.

Follow-Up Questions and Activities

After playing GeoWorld, ask students to discuss their findings and the exploration process. We suggest compiling the class's findings on a large map by using different colored markers. Or, you may want to make a chart. Here are some questions for leading follow-up discussions:

General Questions

1. Where did you find large amounts of the resource?

2. Did you find the resource in the areas you expected to? Were you surprised to find it in some countries and not in others?

3. Describe the distribution of this resource around the world. Do many countries contain this resource or just a few?

4. What strategies did you use to locate resources?

5. How did the geological tests help you decide where to mine?

6. What are the advantages and disadvantages of mining without performing any geological tests?

7. Did you use outside materials such as atlases and encyclopedias? If so, what did you use them for?

8. If you could play again, what would you do differently?

9. What other decision-making processes are similar to searching for resources?

10. If you searched for more than one resource, compare the distribution of the resources.

11. If you played the game version, how much money did you spend? How did you spend your money? How could you save more money?

12. If you played in small groups, how easily did your group make decisions? What did the group do when there was disagreement about making a decision?

Follow-Up Discussion Questions, cont.

Earth Science

1. Using a topographical map, examine the geological features of countries which contain large amounts of the resource. Do you see any patterns?

2. Did you find the resource in any of the major mountain ranges?

3. Did you find the resource above 40° N? How do latitude and longitude affect the location of resources?

4. Do research to find out whether this resource will run out in the near future. What do you think will happen if this resource is depleted?

5. Can other resources be used to replace this resource? What are they? What are the pros and cons of using these resources?

6. How could this resource be conserved? Write a plan to conserve this resource in your home, town or city.

7. If you searched for more than one resource, which (if any) resources did you find in the same areas?

8. If you searched the world for more than one resource, which areas have the most resources? Which are rich in all, some or just one mineral? Are there any parts of the world that have no mineral resources?

Social Studies

1. Research a country or region which contains large reserves of the resource. How has the presence of the resource affected the area's development and its relations with other countries?

2. Research a country or region which contains small or no reserves of the resource. How has the absence of the resource affected the area's development and its relations with other countries?

3. How much is the resource worth today? How has the value of the resource changed over time?

4. How much of the resource does the U.S. possess? Does it import or export the resource?

5. If you were the President of the United States, which countries would you want as allies based on their reserves of this resource?

6. Which of the U.S.'s current allies have this resource?

7. If this resource is depleted, how will the U.S. be affected?

8. What role has this resource played in U.S. history? For example, consider the California Gold Rush of 1848-49 and the Oil Embargo of 1973.

9. What resources other than mineral resources are important to countries? What other resources does the United States possess?

10. Discuss the economics of trading and stock-piling resources.

11. Research folklore, myths and superstitions associated with this resource.

12. Research important inventions which use this resource.

Comparing the Simulation to the Real World

1. How is the simulation different from the real world?

2. What resources other than the ones used in the simulation are important to us? What are their uses and where are they located?

3. Research real-world geological tests.

4. Research real-world mining techniques, such as open-pit and underground mining.

5. Research careers related to earth science.

6. Research real-world uses of data bases.

More Ways to Use GeoWorld

After you are familiar with GeoWorld's basic game and research versions, you may want to try some of the following variations. You can select those that best suit your teaching style and your students' needs. Here are some of the options:

Research Version

1. Search for one resource around the world. You may want to assign students different areas of the world to explore. These areas can be identified by sector numbers on the Sector Map. For example, you can divide the world into the following five areas:

   a) **North America** -- sectors 1 through 17

   b) **Central America and South America** -- sectors 18 through 28

   c) **Europe and Northern Asia** -- sectors 29 through 46 and 51 through 53

   d) **Africa and the Middle East** -- sectors 47 through 50 and 56 through 65

   e) **Southern Asia and the Pacific** -- sectors 54, 55

2. Create a resource-profile of a country or region by exploring it for many resources. You may want to divide the resources among students.

3. Investigate the resources of a country currently in the news.

4. Compare the resources in two or more areas of the world.

5. Compare the world-wide distribution of two or more resources.

Game Version

1. Students can play their own games to see how much of a resource they can find before running out of money.

2. You may want to set up a whole class competition, in which students race to:

a) find the largest amount of a resource.

b) find the largest percentage of the world's known reserves of a resource.

c) find a specific percentage of the world's known reserves of a resource.

d) find a specific amount or percentage and have the most money left. In this variation, students must record the amount of money they have left.

e) find a specific amount or percentage by using the fewest mines. Students must keep track of how many mines they have used.

Lesson Plan: *Exploring North America for Coal*

Description of Activity

In this game version of GeoWorld, students compete to find the largest amount of coal in North America.

Objectives

- Helps students identify geological evidence of coal.
- Shows the distribution of coal in North America.
- Encourages students to work as a team.

Time

Approximately three class periods -- the first is spent introducing the topic and GeoWorld, the second is spent playing the game, and the third is spent discussing students' results.

Equipment Needed

A computer lab with enough computers for pairs of students to play GeoWorld at the same time. Printers are helpful but not necessary.

Preparation

1. Reproduce the following worksheets for each pair of students:

   a) the Resource Information Sheet for Coal
   b) the Sector Map and the Political Map
   c) three Test Recorders
   d) the Reference Card
   e) the Game Sheet

2. Make a copy of the *Exploration* side of the disk for each pair of students so they can play at the same time and save their games.

3. If possible, post a large map of North America in the computer lab. During the simulation, you can use it for reference and to mark the locations of deposits.

4. Load GeoWorld into all the computers. Select the game version. (See page 50 for directions.)

5. Divide the class into pairs of students.

Lesson

Explain the game to the class. Each pair of students will be given $5,000 to search for coal in North America. The pair which finds the largest amount in the allotted time of one class period wins. Feel free to change the amount of time to fit your class's schedule.

Distribute copies of the worksheets and maps to your class. Point out that North America includes sectors 1-17 on the map. Go over the Resource Information Sheet for coal with your class. Spend as much time as you wish discussing this background information. If your students

Lesson, cont.

have not used GeoWorld before, we suggest that you demonstrate the program to the whole class. Use the step-by-step directions on pages 10-23 as a guide.

After the computers are set up, students can begin to play. Encourage them to divide up responsibilities so their search will be more efficient. For example, each student could be responsible for reading two meters in the Geochemical Test. You may want to move around the lab to help students use the program and to provide suggestions.

In order to select the winner, you will need to find out how much coal each pair has found. If you have printers available, each pair can print out its results. See page 58 for directions. This will make it easy for you to select the winner. If you don't have printers, ask students to get an on-screen display of their findings and write down the total amount of coal that they found. See page 58 for directions on obtaining an on-screen display.

Discussion Questions

This section provides some questions for a follow-up discussion.

1. How much coal did you find? What percentage of the world's reserves of coal did you find?
2. Where did you find the largest amounts of coal?
3. Where did you find the smallest amounts? Which countries do not have any coal?
4. What strategies did you use for finding coal?
5. How easily did you make decisions? What did you do when there was disagreement?
6. Are there deposits of coal in your state? If not, from where does it get coal?
7. Using a topographical map, look at the geological features of North America, such as mountains and rivers. What features are near large coal deposits? Can you explain this?

Additional Activities

1. Research the pros and cons of using coal for energy.
2. Compare coal to another fuel, such as oil.

3. Select one state which has large deposits of coal. Research how this resource has affected the state's development.

4. Research the methods used to mine coal.

5. Research how mining for coal affects the lives of the people who live near the mines.

6. Examine the Fact Sheet on page 114. Discuss the importing and exporting of coal.

Searching for Coal Around the World
Repeat the activity, each time exploring a different continent. Which continents have the largest amounts of coal? Which have the smallest?

Research Profile of North America
Suggest several resources which are found in North America, such as oil and silver, and let each pair of students select one. Have the pairs search for these resources. Then, discuss which parts of North America have abundant reserves. You may want to add different colored markers to the classroom map to represent large deposits of each resource.

Coal Versus Oil
Use the research version to compare the distribution of oil and coal. Divide the class in half and assign one fuel to each half. When students have finished searching for their resource, pool the information on a large map by using different colored markers. Discuss the advantages and disadvantages of using each resource for fuel.

One-Computer Classroom
Explore North America for coal with the class as one group. Try to find as much coal as possible before the class runs out of time or money.

Additional Activities, cont.

Lesson Variations

Lesson Plan: *Common and Rare Resources*

Description of Activity

In this research version of GeoWorld, students gather information on the distribution of common and rare resources.

Objectives

- Examines the differences in the world-wide distribution of four resources.
- Compares common and rare resources.
- Encourages students to look for patterns in resource distribution.

Time

Two to three class periods.

Equipment Needed

A computer lab with enough computers for students to work individually or in pairs.

Preparation

1. Choose two common resources, those found in many countries, and two rare resources, those found in few countries. Here is a list of some resources:

Common	Rare
Coal	Tin
Oil	Chromium
Copper	Cobalt
Iron	

2. Reproduce for each student or pair the Sector Map, the Political Map and the Resource Information sheets for the selected resources. If possible, post a large map in the computer lab. Throughout the simulation, you can use it for reference and to mark locations of deposits.

3. Make a copy of the *Exploration* side of the GeoWorld disk for each student or pair. This way, students can play at the same time and save their games.

Computer Lab Set-Up

These directions are for a lab with 16 computers. Adapt them to suit the number of computers you have available.

a) When you load GeoWorld into the computers, select the research version.

b) Choose the first resource for the first four computers.

c) Select the second resource for the next four computers, and so on.

Lesson Plan: *Common and Rare Resources*

Lesson

Hand out the Resource Information Sheets and maps. Discuss the uses of each resource. We suggest that you do not tell students which resources are common and which are rare, so they can make the discovery themselves. Ask students to predict which two resources are rare and which two are common.

Divide the class into five teams. Use the Sector Map to assign each team a different area of the world to explore:

a) **North America** -- sectors 1 through 17;
b) **Central America and South America** -- sectors 18 through 28;
c) **Europe and Northern Asia** -- sectors 29 through 46 and 51 through 53;
d) **Africa and the Middle East** -- sectors 47 through 50 and 56 through 65;
e) **Southern Asia and the Pacific** -- sectors 54,55, and 66 through 79.

Each team must divide the four resources among its members. In the lab, students use the appropriate computer to search for their resource in their assigned world area. When students have completed their search, each team meets to discuss its findings. If you have printers available, students can print out reports to make it easier to share information.

After the simulation, ask each team to report the results of its world-wide search to the class. You may want to pin markers on a map of the world to show large deposits of each of the four resources. You can use this map as a reference for starting discussions.

Discussion Questions

You may want to use these questions for leading a follow-up discussion:

1. Describe the world-wide distribution of each resource. Which are common and which are rare? Were your predictions accurate?

2. Where did you find large deposits of each of the four resources?

3. Which countries, if any, contain all four of the resources? Which countries, if any, contain none of the resources? Which contain just the rare resources? Which contain just the common resources?

Discussion Questions, cont.

4. Compare the U.S.'s supplies of the four resources to supplies in the rest of the world.

5. What are the geological features, such as rivers and mountains, which are near large deposits of the resources?

6. How does having large supplies of a rare resource affect a country?

7. How does having large supplies of a common resource affect a country?

8. Find out the current value of each resource. Which resource is the most valuable? Do research to find out how the value of each resource has changed over time.

Lesson Variation

One-Computer Classroom
Select two resources, one common and one rare. Ask students to research the locations of these resources as homework. Set up the computer so the class can see the monitor. Lead the class through a search for these resources, one at a time. Ask students for suggestions of which areas to explore, test and mine.

Lesson Plan: *World Resource Distribution*

Description of Activity

In this class research project, students search the world extensively for three resources.

Objectives

- Introduces students to the concept of resource distribution.
- Demonstrates the *haves* and *have-nots* in the world for the chosen resources.
- Provides a context for considering the role which resources play in different countries' economic and political development.
- Encourages students to work as a team.

Time Required

Approximately two class periods of computer time.

Equipment Needed

Computer lab with enough computers for students to work at the same time, either individually or in pairs.

Preparation

1. Select three resources which have a common theme, such as energy (coal, oil and uranium) or precious metals (copper, gold and silver).

2. Make copies of the following materials for each student:

   a) Resource Information Sheets (pages 93-107) for the resources you have selected;

   b) the Sector Map and the Political Map;

   c) Reference Card.

3. Distribute the hand-outs and discuss the importance and uses of each of the resources.

4. Divide your class into 5 groups and assign each group one of the following areas of the world:

   a) **North America** -- sectors 1 through 17;
   b) **Central America and South America** -- sectors 18 through 28;
   c) **Europe and Northern Asia** -- sectors 29 through 46 and sectors 51 through 53;
   d) **Africa and the Middle East** -- sectors 47 through 50 and 56 through 65;
   e) **Southern Asia and the Pacific** -- sectors 54, 55 and 66 through 79.

5. You may want to ask students to examine atlases and encyclopedias in preparation for their search.

Lesson Plan: *World Resource Distribution*

Computer Lab Set-Up

These directions are for a lab with 15 computers. Feel free to adapt them to suit the number of computers you have available.

a) When you load GeoWorld into the computers, choose the research version.
b) Select one resource for the first five computers that you load.
c) Select the second resource for the next five, and select the third resource for the last five.

Lesson

After the computer lab has been set up, students can begin to look for the selected resources. Each team divides itself among three computers to search for the three different resources in its assigned world area. After each session of exploration, ask students to share information with their teammates. If you have printers available, students can print out records of their findings. This will make it easier for them to compile the information.

When the groups have finished exploring their areas, bring all the students together. Ask each group to present its findings. Compile the results on a master map by using different colored markers for each resource.

Discussion Questions

Here are some questions for a follow-up discussion:

1. Which area of the world has the most of each resource?
2. Which area of the world has the least of each resource?
3. How much of each resource does the United States have?
4. To which countries can the United States turn for supplies of these resources? What resources does the U.S. have that these countries need?

Additional Activities

1. Ask students to do follow-up research reports on the world area they explored. How has the presence or absence of these resources affected the development of this area of the world? How do countries which have small or no reserves of these resources obtain them or survive without them?

2. A good way to demonstrate general resource distribution in the world is by using products that are familiar to students. Ask students to bring in labels from food, clothing, appliances, etc. Pin the labels to a map according to where they were produced.

Lesson Plan: *Resource Distribution and U.S. Foreign Policy*

Description of Activity

The class works as a group to research the distribution of resources which are important to the United States.

Objectives

- Reviews resources which are important to the United States' economy.
- Shows the areas of the world where those resources are found.
- Provides a context for considering how the availability of resources affects the development of foreign policy.

Time Required

Three to five class periods.

Equipment Needed

One computer and a monitor, preferably a large screen monitor.

Preparation

1. Reproduce for each student the Political Map in the Teacher's Guide.

2. Discuss the ways in which the United States uses different resources. As homework, give students a list of the resources which are contained in GeoWorld's data base. Ask students to select those they think are most important to the U.S. Remind them to consider the nation's energy and industrial needs.

Lesson

As a class, discuss the students' responses and compile a master list of resources which the United States needs. Discuss which resources are the most important to the U.S., and then choose three or four to use with GeoWorld. Next, have students write down where they believe those resources can be found.

Ask students to pretend that they are the President of the United States and are trying to develop a foreign policy. Which nations would they want as trading partners? Why? Tell students to list these nations in order of their importance to the United States.

Now, using GeoWorld, lead the class through a search for one valuable resource at a time. Explore the nations which students have ranked most important. Do these nations actually contain the important resources? Ask students to use their maps to keep track of the location and size of each deposit the class discovers.

When you have completed your explorations, ask students to evaluate their foreign policies. Did the allies they selected have the desired resources? Ask students to

revise their lists of important nations. Compare the countries on the revised lists to the United States' current allies. Discuss any differences among the lists. When two nations have similar resources, how does the U.S. choose between them?

Lesson Variations

Researching the U.S.'s Current Allies
Using newspapers and other sources of current events, have students make a list of the United States' trading partners and allies. Using GeoWorld, explore those countries to find out what resources they contain. Discuss the role of resource distribution in the development of U.S. foreign policy.

Using a Computer Lab
If you have access to a computer lab, students can carry out similar research on many nations. Ask each student to be responsible for the foreign policy of a different nation. Students may use GeoWorld individually or in pairs to figure out which nations they would want as allies, based on the availability of resources. What are the resource needs of this nation? How are they being met? Which countries have the resources this nation needs? Have students make speeches or write a report describing the foreign policy they have chosen for their nation.

Additional Activity

Have students list other kinds of resources which are important to a nation's growth and development, such as labor, strategic location and technology. Why does the United States develop strong relations with some nations, such as Japan, which are not rich in mineral resources?

A Closer Look at the Data Base and Simulation

The Data Base

GeoWorld contains a huge data base of information on 15 major resources, including the locations, amounts and types of each deposit. Since all this information did not exist in one place, we needed to do extensive research. We compiled the information from a number of geological reference books, including:

U.S. Department of the Interior Mineral Yearbook for 1983
World Atlas of Geology and Mineral Deposits
Oxford Economic Atlas of the World

The total amount of resource reserves for each country is accurate at 1982-83 levels. In some cases, we were unable to find information on the specific locations or amounts of reserves within countries, so estimates were made based on the available data.

The Simulation

One benefit of simulations is that they can make abstract concepts about the real world more tangible to students. The process of designing a simulation involves making many decisions about which aspects of reality to include and exclude. Our goal in creating GeoWorld has been to make an accurate model of the world that is both accessible to students and suitable for classroom use.

Real-world geological exploration is a complicated process which can take many years -- we wanted to create a simulation in which students could find resources in as little as a single class period. Thus, we had to make some compromises. In the real world, there are thousands of different mineral deposits of varying value. So, we decided to limit the number of resources in GeoWorld by selecting fifteen of the most important.

The process of exploration has been reduced to three geological tests and a generic mining procedure. These operations are simplified versions of their real-world counterparts and cover much larger areas. The program presents the test results in ways that are easy for students to comprehend, and at the same time it builds their analytical skills. In GeoWorld, students will understand the process of real-world resource exploration and succeed at it.

The Simulation, cont.

In using GeoWorld, or any simulation, we strongly suggest that you discuss with students the ways in which it is similar to and different from reality. You may also want to assign research projects in which students investigate real-world geological tests and mining techniques.

The Map

In searching for an appropriate map for GeoWorld, we chose the Peter's Projection because it is an equal area presentation of the world. It depicts countries, continents and oceans in proportion to their actual sizes, enabling students to make accurate comparisons.

The Peter's Projection has several advantages over traditional projections. For example, the equator is at the center of the map, allowing equal areas for both hemispheres. Many traditional projections devote two-thirds of their map to the Northern Hemisphere and compress the Southern Hemisphere into the remaining third.

A large Peter's Projection map (35" x 50") is available from the Friendship Press:

Friendship Press Distribution Office
P.O. Box 37844
Cincinnati, OH 45222-0844
(513) 948-8733

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Loading GeoWorld

1. Put the disk into drive 1 with the *Start-Up* side up and close the drive door.

2. Turn on your monitor and computer.

3. The program will load into the computer and the title screen will appear. Press **any key** to move on to the next screen.

Note: The tour of the world will not stop by itself. You must stop it by pressing any key.

4. Now you will get a continuous tour of the world. Press **any key** when you are ready to move on.

5. Next, you will see the following menu:

```
Press 1  to play a new game.
Press 2  to start a research project.
Press 3  to continue a game or project.
Press 4  to delete files from the disk.
```

   - To start a new game, press **1**.
   - To start a research project, press **2** and skip to step 7.
   - To continue playing a game or research project that you have saved, press **3** and follow the directions on page 56.
   - To delete files, press **4** and follow the directions on page 57.

6. If you choose to play a new game, you must decide whether to play a standard game or to change the game set-up. We suggest that you do not make changes until you are familiar with the program. (See page 54 for directions on changing the game set-up.)

   Press **1** to play a standard game.
   Press **2** to change the game set-up.

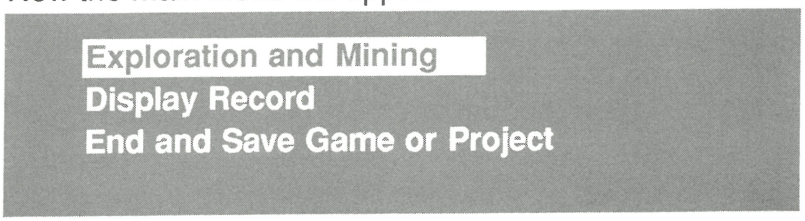
***Tip:** Press **ESC** if you have made a mistake.*

7. Next, you will see a list of the 15 resources for which you can search and mine. You can prospect for only one resource at a time.

   Use the **Spacebar** to move through the alphabetical list to the resource you want. Press **Return** to select your resource.

8. The next screen shows your choice. For example, *Gold is selected.*

9. Now the Main Menu will appear:



   In order to start your search, press **Return** to select *Exploration and Mining.*

10. Remove the disk, flip it over and insert it with the *Exploration* side up. If you are using a copy of the *Exploration* side, insert that disk.

11. Continue by following the directions in the Playing GeoWorld section, pages 52-53.

Loading GeoWorld Into More Than One Computer

1. Follow steps 1-8 in the previous section.

2. When the Main Menu appears, press **Return** to select *Exploration and Mining.*

3. You will get a message to insert the *Exploration* disk. Remove the *Start-Up* disk and insert a copy of the *Exploration* side. Now this computer is ready to use, and you can load GeoWorld into the next computer.

The Start-Up side of the disk is required to load GeoWorld. It cannot be copied. You can, however, make as many copies of the Exploration side as you need. This way, many students can play at the same time and save their own games. To make copies, use any Apple Copy program.

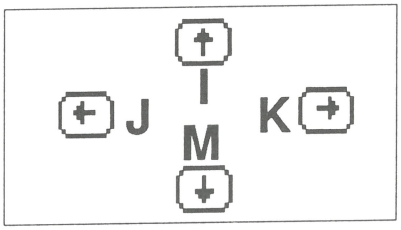
1. Complete steps 1-10 in the *Loading GeoWorld* section.

2. If you want to play the game version, read the game rules on page 10.

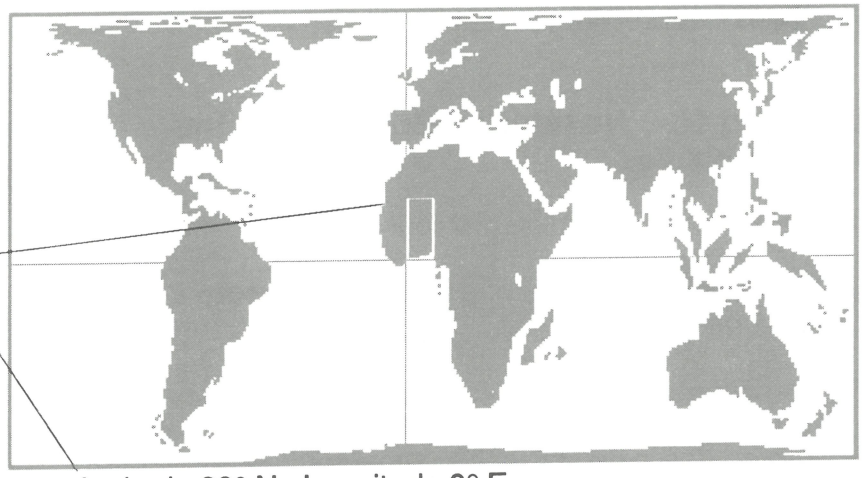
3. Now you can start searching for your resource. The actions you can take are described below. See pages 12-18 for more information on the geological tests.

a) Selecting a World Area to Explore

Note for Apple II+ Users:
When the directions call for the arrow keys use I, J, K and M.



Now you will see a full-screen map of the world. You must select an area of the world to explore by moving the highlighted box. This box encloses 20° by 20° sectors of the world. Your starting position is latitude 20°N and longitude 0°E. You can explore this area or use the ↓↑←→ keys to move to another location. Press **Return** to select the area you want to explore.



Note: The latitude and longitude always refer to the top left corner of a sector.

Your starting position — Latitude 20° N Longitude 0° E

b) Performing a Geochemical Test

Press **Return** to select ***Geochemical Test***. It will test the area for evidence of your resource.

c) Performing a Core Sample

Use the **Spacebar** to move the cursor to ***Core Sample*** and press **Return**.

Use the ↓↑←→ keys to move the flashing box to the area you want.

Press **Return** to perform a core sample on that area.

d) Examining Diagrams of Underground Cross Sections

Use the **Spacebar** to move the cursor to ***Diagrams*** and then press **Return**.

Use the ↑←→↓ keys to move the flashing box to the area you want to examine.

Press **Return** to get diagrams of that area.

Note: You cannot get diagrams until you perform a core sample on the area. In the real world, geologists use the information from core samples to construct diagrams.

e) Mining for Your Resource

Use the **Spacebar** to move to ***Mine*** and press Return.

Use the ↑←→↓ keys to move the flashing box to the area you want to mine.

Press **Return** to start mining.

The results are posted on the screen. For example:

Mining Results	
Oil	100,000 KILOTONS

Changing the Game Set-Up

After you are comfortable with GeoWorld, you may want to experiment with the game set-up. You can change both the amount of cash students receive at the beginning and their starting position in the world.

1. Press **1** to start a new game.

2. Press **2** to change the game set-up.

***Tip**: Press **Esc** if you have made a mistake.*

3. Now you can change the amount of money given to students at the beginning of the game. The amount can be up to $9,999. Type in the amount, and then press **Return**.

4. Next, you can change the starting position for exploration. For example, if you are focusing on North America, you may want to change the starting location to North America so that students will not have to spend as much money moving there.

   To move to an area use the ↑←→↓ keys.

   To select that area press **Return**.

Saving a Game or Research Project

1. When you are ready to quit, select **Leave**. You will return to the Main Menu.

2. Use the **Spacebar** to move to *End and Save Game or Project* and press **Return**.

3. You will be asked, *Do you want to save your work?* Type **Y** if you want to save your work or **N** if you don't.

4. If you choose to save your work, you will be asked to name it. The name can be up to 10 letters long. You can use spaces but no punctuation marks.

***Tip:** Use the ← key or the **delete key** to make corrections.*

5. Now, GeoWorld will ask if you want a **history file**. By saving your game as a history file you will be able to print a report of your findings and transfer the information to AppleWorks. You can use the AppleWorks data base program to manipulate your data, or use the word processor program to write and print out reports. See page 61 for more information on creating a history file.

6. When you have finished saving your work, you will be able to continue using GeoWorld.

Classroom Management Tip

We suggest that students name their files with their own names. This will help you keep track of which files belong to which students.

***Note:** Each time you save a game or a research project it is called a file. You can save up to 15 files on an Exploration disk. The program will let you know when the disk is full and will give you the opportunity to delete files.*

Continuing a Saved Game or Project

1. Follow steps 1-4 in the Loading GeoWorld section on page 50.

2. Press **3** to *Continue a game or project.*

3. You will receive a message to insert the *Exploration* disk. Remove the *Start-Up* disk and replace it with the *Exploration* disk which contains your saved files. Then press **any key**.

4. Now you will see a list of all the games and research projects that have been saved on the disk.

5. Use the **Spacebar** to move through the list and press **Return** to select the one you want.

6. Now you can continue your search.

Deleting Files from the Disk

1. Follow steps 1-4 in the Loading GeoWorld section on page 50.

2. Press **4** to delete files from the disk.

3. Next, remove the disk and either insert it with the *Exploration* side up or insert a copy of the *Exploration* side. Then press **any key**.

4. The screen will list all your saved games and research projects. Each of them is called a file.

5. Use the **Spacebar** to move to the file you want to delete. Press **Return** to select it for deletion.

6. After you press **Return**, the message, *To be deleted*, will appear next to the selected file.

7. You can delete as many files as you want.

8. When you are finished, use the **Spacebar** to move to *End Deletion*. Press **Return**. The files you have chosen will be erased from the disk.

***Tip**: If you decide not to delete any files, press ESC. You will return to the previous menu.*

***Note**: An Exploration disk can contain as many as 15 files.*

Getting a Record of Your Findings

Displaying a Record on the Screen

GeoWorld keeps a record of the amount of the resource that you have found. You can see the record at any time during a game or project. By printing a report, you can obtain even more information. (See the next section for directions.)

1. Go to the Main Menu screen.
2. Use the **Spacebar** to move to *Display Record* and press **Return**.
3. You will now see a record of your work. For example:

> Mining Record
>
> Resource: Oil
> Total Amount Found: 499,000 KILOTONS
> % of the World's Known Reserves: 14.9%

Printing a Report of Your Findings

A GeoWorld report presents information on the locations where you found the resource, including each location's latitude and longitude; the amount of each deposit; the percentage of the world's known reserves of the resource; the deposit type; the total amount found; and the total percentage of the world's known reserves of the resource.

1. Save your game or research project by following the directions on page 55.
2. Type **Y** to create a history file.
3. Next, press **1** to create a word processor file. You will receive the message: *Putting group history in GWDATA.TXT file.*
4. Type **Y** to print the file. Check to make sure your printer is properly attached and turned on.
5. GeoWorld next asks which slot your printer card is in. Type in the slot number. If you are not sure, type **1**. The printer will now print out a report of your findings.

Using AppleWorks With GeoWorld

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Activities Using GeoWorld and AppleWorks 86

This section contains step-by-step directions for using AppleWorks. It will guide you through all the steps in creating your first data base and word processing document. The directions are written for people who have never used AppleWorks. If you are already familiar with the program, you will need to read only pages 61-62, 64 and 80.

Introduction

GeoWorld is designed to work with AppleWorks, a powerful data base, word processor and spreadsheet program. After exploring the world for resources, students can easily transfer their geological findings to AppleWorks. This enables them to create their own data bases without having to input the data into the computer -- a time-consuming and often unrewarding task. Using AppleWorks' data base program, students can gain new insights into their data by manipulating it in different ways and performing calculations. Also, they can use the word processor to write and print out reports on their findings.

Sample Data Base

Lat.	Long.	Amount in 1000 oz	% World's Reserves	Deposit Type
25 S	25 E	10000	22.6	SED
28 S	25 E	5000	11.3	SED
25 S	28 E	5000	11.3	SED
23 S	30 E	2000	4.5	IGN
		22000*	49.7*	

** Indicates a total*

Sample Word Processor Document

Mining Report for Gold

We started prospecting for gold in South Africa. We found 22,200,000 ounces of gold which is 50.2 % of the world's known reserves of this valuable commodity. We were surprised to find so much gold in such a small area of the world.

This chart shows the locations of largest gold deposits we found in South Africa.

THE UNIT OF AMOUNT IS IN 1,000 OZ

LAT	LONG	AMOUNT	%	ENV
25S	25E	10,000	22.6	SED
25S	28E	5,000	11.3	SED
28S	25E	5,000	11.3	SED
23S	30E	2,000	4.5	IGN
20S	28E	200	0.5	IGN
Total is		22,200	50.2	

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Saving A Game or Research Project to Transfer it to AppleWorks

After you have searched for a resource in GeoWorld, you can save your findings as a history file. This file contains a "history" of each place you mined successfully -- the latitude and longitude, the amount of the resource you have found, the percentage of the world's known reserves of that resource and the type of deposit (sedimentary, igneous or metamorphic).

1. You can create a history file whenever you save a game or research project. When you have finished exploring, select *End and Save Game or Project* on the Main Menu screen.

2. Then, type **Y** to save your work. Now type in a name for your game or project. Names can be up to 10 letters long. You can use spaces but no punctuation marks. For example: **Amy B Oil**

3. Next, type **Y** to create a history file. Now you will be asked to choose either a word processor file or a data base file:

   A word processor file enables you to print a report of your findings and to transfer them to AppleWorks' word processor program. You will be able to edit the information in your document, change the layout and add written descriptions. However, you will not be able to ask the program to arrange, sort or perform calculations on your data.

   A data base file allows you to transfer information to AppleWorks' data base program. You will be able to arrange, sort and perform calculations on the data you have gathered. You can also add or delete information and change the layout. However, you cannot add a written description of the data.

Warning

You can save only one history file on your GeoWorld Exploration disk at a time. Each time you create a history file, the program automatically erases the previous one. We suggest that you transfer your history file to AppleWorks as soon as possible.

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4. If you want to create a word processor file, type **1**. Read the directions on pages 80-82.

   If you want to create a data base file, type **2**. Follow the directions on the next page.

5. Now you are ready to use AppleWorks.

Tip: *If you have saved a game or project without creating a history file, you can still create a history file. You need to reload the game or project, and then save it again as a history file. Load GeoWorld and choose to continue a game or project. Then, select the file that you want. Next, choose "End and Save Game or Project " and follow steps 1-5 described above.*

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What You Will Need

- An Apple IIc, IIe or IIgs computer
- An 80-column or extended 80-column text card for the Apple IIe only
- A video monitor
- A GeoWorld *Exploration* disk which contains a history file
- A copy of the AppleWorks *Startup* and *Program* disks
- A ProDOS formatted disk for saving your work

Optional:

- A printer
- An AppleWorks Reference Manual and Reference Card

Loading AppleWorks

1. Insert the AppleWorks *Startup* disk into the disk drive.
2. Turn on your monitor and computer.
3. The program will load into the computer and you will see the title screen.
4. At the bottom of the screen you will be asked to place the *Program* disk in drive 1. Remove the *Startup* disk from the disk drive, and then insert the *Program* disk.

***Tip:** Make sure the Program disk does not have a write-protect tab.*

5. Press **Return**.
6. Next, type in the date and press **Return**. Now you are ready to transfer your findings to AppleWorks.

Note: If your AppleWorks program has not been used before, you will need to make copies of the original "Startup" disk and "Program" disk. These disks are write-protected to prevent accidental damage. To make copies, use any Apple copy program.

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Transferring Your History File to the AppleWorks Data Base Program

This section will guide you through all the steps in creating an AppleWorks data base.

1. Follow the directions in the Loading AppleWorks section. When you complete step 5, the Main Menu will appear on the screen.

2. Type **1** to *Add files to the Desktop,* and then press **Return**.

3. The next menu, *Add Files*, will appear. Type **4** to *Make a new file for the Data Base.* Press **Return**.

Category: One kind of information in a data base file. Your GeoWorld data base will include these categories: Latitude, Longitude, Amount, and Percentage of World's Known Reserves.

4. Next, type **2** to *Make a new file from a text (ASCII) file.* Then press **Return**. You will be asked *How many categories per record? (1-30).*

5. Type **7**, then press **Return**.

6. Remove the *Program* disk from the drive and insert the disk with your saved GeoWorld file.

Pathname: The "pathname" tells AppleWorks the path it must follow to find the file.

7. Now you must type in the file's pathname. Type:
   /geoworld/gwdata.txt

   Make sure you include both slashes (/). Use this pathname every time you transfer a file from GeoWorld to AppleWorks.

8. Press **Return**. You will receive the message, *Getting the File.*

Tip: *If you receive the message:* ***Cannot find file,*** *you probably pressed* ***Return*** *before you inserted the disk which contains your GeoWorld history file. Insert that disk. Then, select* ***Yes*** *to try again.*

Note: Filenames can be up to 15 characters long and must begin with a letter. Periods are the only punctuation marks you can use.

9. You will now be asked to name the data base file. Type **First Data Base** and press **Return**.

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10. Remove your GeoWorld disk and insert the AppleWorks *Program* disk. You will see a screen displaying columns of information on the places where you mined. You have now transferred your history file to AppleWorks.

This is how your data base will look:

File: First Data Base REVIEW/ADD/CHANGE Escape: Main Menu
Selection: All records

Category 01	Category 02	Category 03	Category 04	Category 05
20	S	28	E	200
28	S	25	E	5000
25	S	25	E	10000
25	S	28	E	5000

Tip: *You can get help information on AppleWorks by pressing* ***open-apple*** *(when it appears on the screen). Use the ↑ and ↓ keys to move through the information. Press* ***Esc*** *to leave the help feature.*

Note: *Only five columns of information are being displayed because there isn't enough room on the screen to show all seven. You'll be able to adjust the layout later on, so you can see all the categories on the screen at once.*

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Data Base Vocabulary

This sample data base has been labeled to introduce you to the basic vocabulary:

Lat.	Long.	Amount in 1000 oz	% World's Reserves	Deposit Type
25 S	25 E	10000	22.6	SED
28 S	25 E	5000	11.3	SED
25 S	28 E	5000	11.3	SED
23 S	30 E	2000	4.5	IGN

Entries are single pieces of information, such as 10,000 or SED .

Categories are a certain type of information such as Longitude or Deposit Type.

Records are all the information about one location where you mined. All the information about Lat. 25° S, Long. 25° E is one record. All the information about Lat. 28°S, Long. 25°E is another record.

How to Move the Cursor

The following chart summarizes how to move the cursor when you are working on your data base:

To Move the Cursor to:	Press:
The next entry	Tab *
The previous entry	Open apple-Tab *
The right within an entry	→ key
The left within an entry	← key
Down one category	↓ key *
Up one category	↑ key *
The top of the screen	Open-apple- ↑
The bottom of the screen	Open-apple- ↓

* (cursor must be on the first character of the entry)

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Naming Categories

Let's begin by naming the categories so that it will be easier to understand the data base. The current headers, Category 01, Category 02, etc., can be changed to describe the information in each column.

1. Press **open-apple-N** to change the category names.

2. Press **Return** to move the cursor to the first category. Notice that the cursor is flashing on the first letter of **C**ategory 01.

3. Right now, the cursor is a blinking bar. This means that you are in the *insert* mode. When you type, the characters will be inserted at the cursor position, moving the rest of the text further to the right. You can also use the *overstrike* mode which enables you to replace text by typing right over it. Press **open-apple-E** to switch to the overstrike mode. The cursor will change to a blinking rectangle.

***Tip**: You can switch between the the insert and overstrike modes by typing **open-apple-E**.*

4. The first column contains information on the latitude of the places where you found a resource. Type **Lat.** Then, press **open-apple-Y** to delete the rest of the line.

***Tips for Deleting Information:** If you want to delete characters one at a time, use the **delete** key. Place the cursor one character to right of the text you want to delete. Each time you press **delete,** one character to the left of the cursor is erased. Alternatively, you can use **open apple-Y** to delete characters from the cursor position to the end of the line or entry.*

5. Press **Return** to move to the next category. Since the information in this column is also on latitude, it does not need a separate heading. Press the **Spacebar** repeatedly to replace the heading with blank spaces.

6. Press **Return** to move to Category 03. This column provides information on longitude, so type **Long.** Then press **open-apple-Y** to delete the rest of the line.

Now you can start setting up your data base. You will be able to change the data base in several ways, including naming the categories, changing the layout, and arranging the categories alphabetically or numerically.

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7. Press **Return** to move to Category 04. This category also provides information on longitude so it doesn't need a separate title. Press the **Spacebar** repeatedly to erase the heading.

8. Move to Category 05 by pressing **Return**. This category displays the amount of a resource that you found. Type **Amount** and then press **open-apple-Y** to delete the rest of the line.

9. Press **Return**. Category 06 provides information on the percentage of the world's known reserves of the resource you have found. Type **%** and then press **open-apple-y**.

10. Press **Return** to move to Category 07, which lists the type of deposit (sedimentary, metamorphic and igneous) in which your resource was found. Type **Deposit Type** and press **Return**.

11. Press **Esc** to see your data base with the new headings. It will look like this:

Lat.		Long.		Amount
20	S	28	E	200
28	S	25	E	5000
25	S	25	E	10000
25	S	28	E	5000

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Changing the Layout

Now let's move the categories closer together so you can see all seven on the screen at once.

1. Press **open-apple-L** to change the layout. Your options are listed on the top half of the screen.

2. The cursor is on the Lat. category. Press **open-apple-→ 11** times to move the second category closer to the first.

3. Press the → key to move the cursor to the second category. Press **open-apple-← 10** times to bring the third category closer to the second.

4. Move the cursor to the third category, Long., by pressing the → once. Press **open-apple-← 10** times to move the fourth category closer to the third.

5. Press the → **1** time to move to the fourth category. Press **open-apple-← 9** times.

6. Move the cursor to the fifth category, %, by pressing the by pressing the →. Press **open-apple-← 5** times to decrease the space between the two categories. Now all seven categories will be shown on the screen.

8. Press **Esc**. You will be asked, *What direction should the cursor go when you press Return? 1. Down (Standard) 2. Right.*

9. Press **Esc** or **Return** to select Down.

10. Now your data base will look like this:

File: First Data Base REVIEW/ADD/CHANGE Escape: Main Menu

Selection: All records

Lat.	Long.	Amount	%	Deposit Type
20 S	28 E	200	0.5	IGN
28 S	25 E	5000	11.3	SED
25 S	25 E	10000	22.6	SED
25 S	28 E	5000	11.3	SED
23 S	30 E	2000	4.5	IGN

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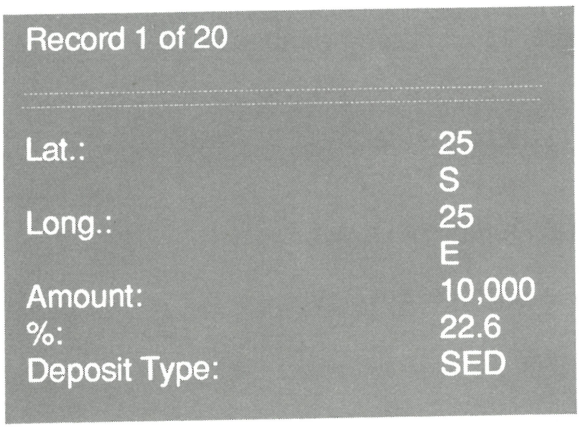
Multi-Record & Single-Record Layouts

There are two ways to display your data base on the screen:

Multi-Record Layout. Right now your data base has a multi-record layout. AppleWorks presents information for many records on the screen at once. The amount of information displayed is limited by the width of the screen. Your data base is small enough for all the categories to fit on the screen. However, if the data base had 30 categories, AppleWorks could not display all the information on each record.

Single-Record Layout. You can also get a close-up of each record. A single-record layout will display all the information for one record. Place the cursor anywhere on the record you want to examine and press **open-apple-Z** to zoom in on it. Here is a sample single-record layout for a large deposit of gold:



If you want to see other records in the single-record layout, press **open-apple-** ⊕ to move to the next record. Notice that the number at the top of the screen will increase: Record **2** out of 20.

If you want to see a lower numbered record, press **open-arrow-** ⊖ .

If you want to return to the multi-record layout, press **open-apple-Z** to zoom out.

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Arranging the Information

1. Make sure you are in the multi-record layout. If you are not, press **open-apple-Z**.

2. Let's list the resource amounts from largest to smallest. Press the **tab** key **4** times to move the cursor to the **Amount** category.

3. Press **open-apple-A.** You will now see the following screen:

This file will be arranged on this category: Amount

Arrangement Order:

1. From A to Z
2. From Z to A
3. From 0 to 9
4. From 9 to 0

4. Type **4** and press **Return** to arrange the amounts numerically from largest to smallest.

5. Now you will see your revised data base. The following data base has been arranged from largest to smallest amounts:

Now you can change the order of the items in the categories. They can be arranged alphabetically or numerically.

File: First Data Base REVIEW/ADD/CHANGE Escape: Main Menu
Selection: All records

Lat.		Long.		Amount	%	Deposit Type
25	S	25	E	10000	22.6	SED
28	S	25	E	5000	11.3	SED
25	S	28	E	5000	11.3	SED
23	S	30	E	2000	4.5	IGN
20	S	28	E	200	0.5	IGN

There are many other ways to arrange your data base. For example, you could list the latitudes from smallest to largest or list the deposit types alphabetically.

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Selecting the Information You Want to Display

Currently, all the information in your data base is being shown on the screen. In order to help you analyze the data, you may want to look at only certain records at a time. You can direct AppleWorks to select and display some of the data. This is called writing a "selection rule." For example, if you want to know where you found the largest amounts of oil, you could ask the program to select the amounts which are greater than 100,000 Kilotons.

In this sample activity, you will direct AppleWorks to display information for only those locations which contain over 5% of the World's Reserves of your resource.

1. Press **open-apple-R** to change the selection rules.

2. Type **6** to select the category, %. Press **Return**. Now you will see a list of terms you can use in your selection rule.

4. Type **2** to select *is greater than.* Press **Return**.

5. At the top of the screen you will see, *Selection: % greater than.* Since you want to select the deposits that are greater than 5%, type **5** and press **Return**.

6. The next screen lists the connectors -- and, or, through -- which you can use to write more complicated selection rules. Let's leave the selection rule simple, so press **Esc**.

Tip: *There are many ways to use the connectors. For example, you could have the program select only the percentages of World's Reserves which are greater than 2* ***and*** *less than 10. Or, direct the program to select only the percentages of World's Reserves which are greater than 5* ***or*** *have latitudes which are greater than 20°* ***and*** *less than 30°.*

7. Now your data base will display only the records for the mines which found more than 5% of the world's reserves. The rest of the information is still in your data base, even though it is not displayed on the screen.

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Now the sample data base will display only three records:

Selection: % World's Reserves is greater than 5

Lat.		Long.		Amount	%	Deposit Type
25	S	25	E	10000	22.6	SED
28	S	25	E	5000	11.3	SED
25	S	28	E	5000	11.3	SED

8. If your data base is not displaying any records, then you did not find any deposits which contain over 5% of the world's known reserves of the resource. Write a new selection rule to select deposits which contain over 2% of the world's known reserves. Repeat steps 1-4. At step five, type **2** and press **return**.

Tip: *If you want to see all the information on the screen again, press* ***open-apple-R****. The message at the bottom of the screen will ask: "Select all records? No Yes." Use the → key to move the cursor to* ***Yes*** *and press* ***Return****. Now, all your records will be displayed.*

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Creating a Report

In order to print out your data base, you need to create a "report." AppleWorks allows you to set up the way you want your report to look when it's printed. For example, you can decide which information you want to include, and you can change the layout. Setting up a report also enables you to calculate the totals of different categories, such as the total amount of the resource you have found. In addition, you can transfer your report to the word processor program where you can revise it or add a written description.

1. To start setting up a report, press **open-apple-P**. You will now see the Report Menu.

2. Now you must decide which type of report format you want. There are two basic formats for reports:

   A **tables** format is similar to a multi-record layout.

   A **labels** format lists records with the categories printed vertically down the page and is similar to a single-record layout.

   Type **2** to *Create a new "tables" format.* Press **Return.**

3. Type in a name for the report. The name can have up to 19 characters. For example, type **Sample**.

4. Press **Return**.

5. You will now see the Report Format screen. You can adjust the layout of the report in the same way that you changed your data base.

6. Let's move the categories closer together so you can see all seven at once. Press **open-apple-**◄ to move the second column closer to the first. Use the ► to move to the second column. Press the **open-apple-**◄ to move the third column closer to the second. Continue to adjust the layout until you are pleased with the way it looks.

   See page 69 for more information on adjusting the layout.

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Calculating Totals

You can direct AppleWorks to make calculations, such as adding up the deposit amounts. This is called a category **total**.

1. Use the ⊕⊕⊕⊕ keys to move the cursor to the Amount column.

2. Press **open-apple-T**. Now you must type in how many decimals places you want included in the total. Since the column contains only whole numbers, you will not need any decimal places.

3. Press **Return** to select 0. AppleWorks will ask how many blank spaces should be left after this category on the report.

4. Press **Return** to leave 3 blank spaces. All the numbers in the Amount column will be changed to nines. This is to show that the category will be right justified -- all the numbers will be properly lined up. When you print the report, the nines will be replaced with the actual numbers, and the double dashes will be replaced with the totals.

5. You may also want to calculate the total percentage of the world's known reserves of the resource.

   a) Move the cursor to the **%** category.
   b) Press **open-apple-T.**
   c) Next, type **1** to leave one decimal place and press **Return**.
   d) Then press **Return** to accept 3 blank spaces.

6. Now all the numbers in the % category will be changed to nines.

This sample data base is set up to calculate totals in two categories:

File: Gold
Report: Sample
Selection: % is greater than 5

Lat.		Long.		Amount	%	Deposit Type
25	S	25	E	9999999	9999999.9	SED
28	S	25	E	9999999	9999999.9	SED
25	S	28	E	9999999	9999999.9	SED
23	S	30	E	9999999	9999999.9	IGN

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Removing Totals

This section describes how to stop the program from calculating and displaying totals.

1. Move the cursor to the category from which you want to remove the totals.

2. Press **open-apple-T**. Your original numbers will replace the nines.

Additional Calculations

Note: You can have up to three calculated categories in each data base report.

AppleWorks can perform calculations on one or more categories and place the results in a new category. For example, if you want to find out how much your resource is worth, you can create a new category which will calculate and display the cost of each deposit. This is called a **calculated category**.

Note: AppleWorks always places a calculated category one column to the left of the cursor.

1. Let's place the calculated category between the Amount and % categories. Move the cursor to the % category.

2. Press **open-apple-K**. You will see a new column on the screen. The column is filled with nines. It is labeled *Calculated*, but you can change the name.

Note: Category names can be up to 20 characters long.

3. Type a name for the category, e.g. **Worth**. Use **open-apple-y** to delete the rest of the previous name. Press **Return**.

Use the following keys:	
plus	+
minus	-
multiply	*
divide	/

Calculations are performed from left to right.

4. Now you must describe how you want the calculations to be made. This is called a **calculation rule**. Each category is labeled by a letter on the screen. For example, the Amount Category is labeled E. Make sure you use these letters when you write a calculation rule.

5. Use the financial section of a newspaper to find out the current worth of your resource. Or, you may want to estimate the cost. Then, type a calculation rule for your resource. Press **Return**.

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Example: You could calculate the worth of each gold deposit in the sample data base. You'll need to multiply the amount of each deposit by the current cost of gold - $419 an ounce. Since GeoWorld measures gold in 1,000 ounce units, you'll need to convert the numbers in the Amount column into ounces by multiplying them by 1,000. In order to direct AppleWorks to carry out these operations, you would type:

E * 419 * 1000

(Amount * Cost of gold per ounce * 1000)

6. Next, you must decide how many decimal places to include in this category. Since you are multiplying whole numbers you will not need any decimal places. So, press **Return** to choose 0.

7. Now you must decide how many blank spaces should be left after the category. Press **Return** to select 3.

8. You can also find out the total worth of all the deposits you found by asking for a category total. Press **open-apple-T**. Then press **Return** 2 times.

9. You cannot see the results of these calculations until you print the report on a printer or display it on the screen. See page 79 for directions on printing reports.

When the report is printed it will look like this:

File: Gold
Report: Sample
Selection: % is greater than 5

Lat.		Long.		Amount	Worth	%	Deposit Type
25	S	25	E	10000	4190000000	22.6	SED
28	S	25	E	5000	2095000000	11.3	SED
25	S	28	E	5000	2095000000	11.3	SED
				20000*	8380000000*	45.2*	

An asterisk indicates a category total.

Note: In this sample data base, $8,380,000,000 worth of gold was found.

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Changing a Calculated Category

1. If you want to change a calculated category, move the cursor to it. Press **open-apple-K**.

2. At the bottom of the screen, you will see the message,

   Calculated category? Create New Edit Column F.

3. Use the **right arrow** key to move the cursor to *Edit column F* and press **Return**.

4. Now you will be able to change the category name, the calculation rules, the number of decimal places and the number of blanks left after the category.

Displaying a Data Base Report on the Screen

You can see the results of your calculations by displaying your report on the screen. In AppleWorks this is described as "printing the report on the screen."

1. Press **open-apple-P** to print your report. Now you must choose where to print the report.

2. Type **3** to select *the screen.*

3. Press **Return**.

4. The next screen describes how to stop and pause during printing. Press **Return** when you are ready to move on. Your report will be displayed on the screen. An asterisk indicates a category total.

5. Press the **Spacebar** when you are finished looking at the report. You will return to the Report Menu.

Tip: *If a column is filled with ####, that means that there aren't enough nines on both sides of the decimal point to hold the largest and smallest calculated numbers. You'll need to add more spaces.*

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Printing Your Report

1. Press **open-apple-P** to print your report. You will be asked, *Where do you want to print the report?*

   1. Apple DMP
   2. ImageWriter
   3. The Screen
   4. The Clipboard (for the Word Processor)
   5. The text (ASCII) file on disk
   6. A DIF (TM) file on disk

3. Select the appropriate option and press **Return**.

4. See the AppleWorks Reference Guide, Chapter 13 for more information on printing.

Note: If you want to change the way your report is printed, see the section on printer options in Chapter 5 of the AppleWorks' Reference Book. For example, you can change the margins or use boldface.

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Transferring Your History File to the AppleWorks Word Processor

This section provides step-by-step directions for creating your first word processor document.

1. Follow the directions in the Loading AppleWorks section on page 63. When you complete step 5, the Main Menu will appear on the screen.

2. Press **Return** to select *Add files to the Desktop*. The next menu, *Add Files*, will appear.

3. Type **3** to *Make a new file for the Word Processor,* and then press **Return**.

4. Next, type **2** to *Make a new file from a text (ASCII) file.* Then press **Return**.

Note: The "pathname" tells AppleWorks the path it must follow to find the file.

5. Now you must type in the file's pathname. Type: **/geoworld/gwdata.txt** (Do not press **Return**.) Make sure you include both slashes (/). Use this pathname every time you transfer a file from GeoWorld to AppleWorks.

6. Remove the *Program* disk from the drive and insert the disk with your saved GeoWorld file. Press **Return**. You will receive the message, *Getting the File.*

***Tip:** If you receive the message: "Cannot find the file," you probably pressed **Return** before you inserted the disk with your GeoWorld file. You will receive the message,"Try again? No Yes." Insert the disk with the history file. Then, select **Yes** to try again.*

7. You will be asked to name the file. For this sample document, type **Document 1** and press **Return**. Filenames can be up to 15 characters long and must begin with a letter. You can use uppercase or lowercase letters, numbers, periods and spaces.

Note: Periods are the only punctuation marks you can use.

8. Remove your GeoWorld disk and insert the AppleWorks *Program* disk. You will see a screen displaying columns of information on the locations where you mined successfully. You have now transferred your history file to AppleWorks.

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Editing Your Document

Two Ways to Insert Text

AppleWorks has two types of cursors for inserting text -- the insert cursor and the overstrike cursor.

Insert Cursor: This cursor is a blinking bar. When you type, the characters will be inserted to the left of the cursor, moving the rest of the text further to the right.

Overstrike Cursor: This is a blinking rectangle. You can replace existing text by typing right over it.

Press **open-apple-E** to switch between the two cursors.

Now you can edit the information, add to it and print it out. This section summarizes the basic features of the word processor.

How to Edit Text

To:	Press:
Erase one character at a time, starting to the left of the cursor	Delete
Delete text from the cursor to the end of the line	Open-Apple-Y or Control-Y

How to Move the Cursor Without Changing Text

To Move the Cursor:	Press:
From character to character	← → keys
Up or down, one line at a time	↑ ↓ keys
To the first character of the word to the right or the left	Open-apple- → Open-apple- ←
To the bottom of the screen	Open-apple- ↓
To the top of the screen	Open-apple- ↑
Proportionally within a whole document	Open-apple 1- 9 (1 = beginning, 9 = end)

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Suggestions for Editing Your Document

1. Give your report a title. For example, **Mining Report for Oil**.

2. Edit the names of the categories, e.g. change Lat to Latitude.

3. Add commas to the numbers to make them easier to read. For example, change 2500 to 2,500.

4. Change the totals listed at the bottom of the chart to complete sentences. For example, *I found 22,000,000 ounces of gold. This is 49.7% of the world's known reserves of gold.*

5. Write a description of your search for the resource. Where did you search? What strategies did you use?

6. Examine your findings and write a description of them.

7. Use a map to find out which countries contain the largest amounts of the resource. Add this information to your description.

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Printing Your Document

1. Type **open-apple-P**. At the bottom of the screen you will receive the message:
   Print from? Beginning This page Cursor

2. Make your choice and press **Return**.

3. Next, you must decide where you want to print the file:

   1) Apple DMP
   2) ImageWriter
   3) A text (ASCII) file on disk

   Select an option and then press **Return**.

4. Now type in the number of copies you want and press **Return**.

5. See the Apple Reference Manual for more information on printing.

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Note: You can save your work at any time. You will need a Data Disk on which to save your files. A Data Disk is any ProDOS formatted disk. You can use AppleWorks to format a blank disk. For directions, see the AppleWorks' Reference Manual, page 36.

Saving Files in the Middle of Your Work

When you are working on a file, you can save it by pressing **open-apple-S**. Follow the on-screen directions. When AppleWorks has finished saving the file, you can continue working on it. It's a good idea to save your files frequently so that you don't lose any information.

Saving Files When You are Finished Working on Them

1. When you are ready to save your data base, press **Esc**. You will return to the Main Menu.
2. Select **3**, *Save Desktop files to disk*. Then press **Return**.
3. AppleWorks displays a list of files on the Desktop.
4. Select the file you want to save and press **Return**.
5. Next, select **1** to *Save the file on the current disk.*
6. AppleWorks will instruct you to place your Data disk in drive 1 and press **Return**. Remove the program disk from drive 1 and insert your data disk.
7. Press **Return**.

***Tip:** You can press **Esc** to cancel the Save.*

8. When the file has been saved, you will return to the Main Menu.

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Quitting AppleWorks

1. At the Main Menu, select 6 to *Quit* and press **Return**.

2. Now you will be asked: *Do you really want to do this? No Yes.*

3. Select ***Yes.*** AppleWorks will tell you if your work has not been saved and will give you the opportunity to do so.

4. You will now see the message,

   ENTER PREFIX (PRESS "RETURN" TO ACCEPT)

   /APPLEWORKS/

   That means you've left AppleWorks.

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Activities Using GeoWorld and AppleWorks

There are many ways to use GeoWorld and AppleWorks in your computer lab or classroom. You may want to use the programs to introduce students to two important computer applications: data bases and word processing. Or, use the programs to build students' analytical and critical-thinking skills.

Note: If your students are not familiar with AppleWorks, we suggest that you demonstrate it to the whole class. You may want to hand out copies of the directions in this manual. In addition, you can give your students copies of the Apple-Works Activity Worksheets (pp. 110-111).

The following suggestions are just some of the ways you can use GeoWorld and AppleWorks in your classroom:

1. **In-depth analysis:** Have students create their own data bases by transferring their GeoWorld findings to AppleWorks. They can manipulate the data to answer the following questions:

   a) Which locations in their area of the world have the largest deposits?
   b) Which locations in their area of the world have the smallest deposits?
   c) Did any one of their mines uncover over 10% of the world's known reserves of their resource? 20%? 50%?
   d) What is the total amount of the resource found in this area of the world?
   e) What is the total percentage of the world's known reserves of this resource in this area?

2. **Calculating Monetary Value:** Using the financial section of the daily newspaper, ask students to determine the value per unit of each resource. Then, using the AppleWorks data base program, have them make the following calculations:

   a) the monetary value of each deposit;
   b) the total worth of the deposits in a given country;
   c) the total worth of the deposits in a given area of the world.

3. **Reports to the President:** Students assume the role of Presidential Advisors. Their job is to investigate the amount of a resource found in a specific area of the world. Then, using the word processor program they write an analysis of their findings for the President.

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This section provides worksheets which you can copy and distribute to your students. The worksheets on pages 90-109 are designed to help students interpret and record information when they use GeoWorld. The Fact Sheets (pp. 112-114) provide graphs on a variety of topics which are relevant to GeoWorld.

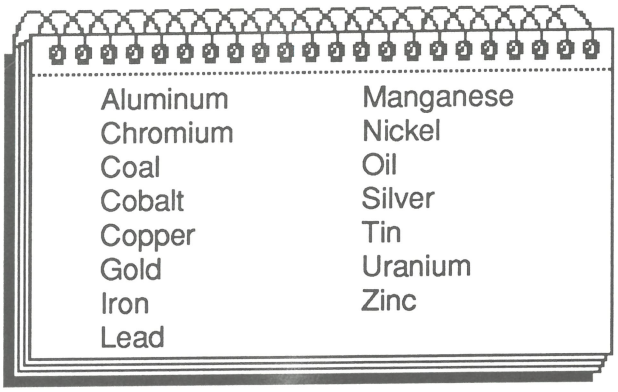
Introduction to GeoWorld

Welcome to GeoWorld! You are the leader of a geological expedition. Your assignment is to search the world for resources. There are many important decisions for you to make -- where to explore, what geological tests to perform and where to mine. The computer plays the role of a team of researchers and geologists. At your command, it performs geological tests, mines for resources, and presents you with the results. GeoWorld also keeps a record of the total amount of a resource that you have found.

How to Find a Resource

Step 1: Choosing a Resource

The first step is to select a resource. You can search the world for 15 major resources: 13 minerals and two fossil fuels. However, you can search for only *one* at a time.

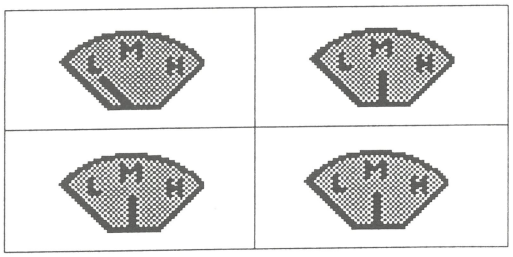


Step 2: Selecting an Area to Explore

The next step is selecting an area of the world to search for your resource. You can explore any of the gray areas on the Sector Map. You may want to use other maps and reference books to help you decide where to explore. Or, you may want to test your own knowledge of which countries have your resource.

Step 3: Performing the Three Geological Tests

In order to help you decide where to mine, you can perform three geological tests. They are similar to the types of tests performed by geologists in the real world. Each test provides a different kind of information to help you figure out where to mine. The three tests are described below:



The Geochemical Test is performed on a large area. It tests the soil, water and air for evidence of the resource. The presence of the resource is measured on a scale of Low, Medium and High.

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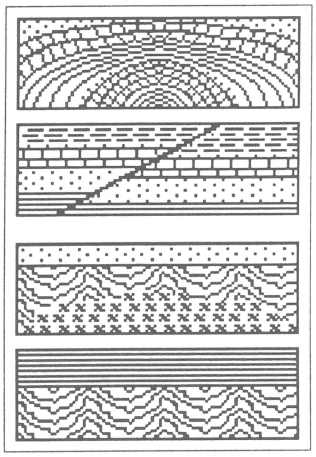
SEDIMENTARY ROCK Bauxite	SEDIMENTARY ROCK Pyrolusite
IGNEOUS ROCK Galena	SEDIMENTARY ROCK Marine Fossils

The Core Sample is used to find out what types of rocks and mineral ores are below the surface. An ore is a rock which contains a useful mineral and can be mined profitably. For example, lead is obtained from an ore called "galena." In the real world, geologists perform core samples by drilling a narrow hole into the earth's crust. Their drills are designed to bring rock samples up to the surface. Then, the geologists examine the samples for evidence of the resource. In GeoWorld, the computer carries out the core sample and gives you the test results. The samples are grouped by rock type -- sedimentary, igneous and metamorphic -- and listed in order of their importance to your resource.



Diagrams are pictures of the way an area looks underground. Geologists use these diagrams to determine which resources are likely to be found in the underground rock formations. In order to make diagrams, geologists first perform many core samples in a small area. By lining up the rock samples, they can construct a picture of the rock formations. Similarly, GeoWorld uses the information from the core sample to draw diagrams of the way the rocks are arranged below the surface. The rock formations which are likely to contain your resource are shown on the Resource Information Sheet. Use this sheet to help you examine the diagrams on the screen.

Tip: *We suggest that you perform the tests in this order -- geochemical, core sample and diagrams. It will help you find resources quickly, without wasting money. However, the program will not force you to do the tests in this order -- you can choose to mine without doing any tests, or you can start your research with a core sample. But, you cannot get diagrams until you perform a core sample on the area because the core sample provides the information needed to create the diagrams.*

Step 4: Mining

After you find evidence of a resource, you can mine for it. You choose an area and GeoWorld will mine it. The program will then tell you how much you have found. For example:

Mining Results

Oil 10,000 KILOTONS

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Game Sheet

Game Rules

1. Your goal is to find as much of a resource as you can before you run out of money. At the beginning of the game, you are given $5,000.

2. The only way you can get more money is to find 10% of the world's known reserves of your chosen resource. You will receive a $1,000 bonus for each 10% that you find. The program will tell you when you have earned a bonus.

3. The cost of each action is listed below:

Geochemical Test	$ 5
Core Sample	10
Diagrams	20
Mine	100
Move to a New World Area	100 - 1,200 *

** (The cost increases with the distance you move.)*

4. The game will end when you have less than $100 because you will not be able to pay for mining. You need to mine in order to make more money.

5. Try to think of strategies for finding your resource. **Good Luck!**

Game Record

Use this chart to keep track of your results.

Resource	Amount Found	% World's Known Reserves	Cash Left

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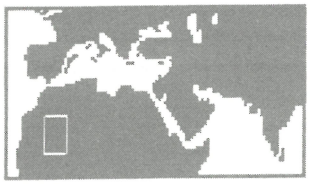
Menus

Use the **Spacebar** to move through a menu. Press **Return** to select. Press **Esc** if you have made a mistake.

Note for Apple II+ Users: When the directions ask for the arrow keys, use **I⊕ J⊕ K⊕ M⊕**

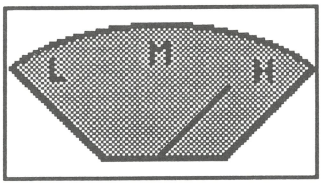
Exploration and Mining

1 Select World Area



Use **Arrow** keys to move to an area.
Press **Return**.

2 Perform Geochemical Test



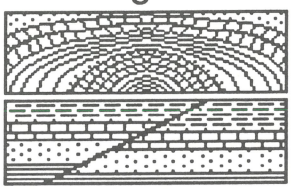
Use **Spacebar** to move to ***Geochemical Test***.
Press **Return**.

3 Perform Core Sample

SEDIMENTARY ROCK Gold	SEDIMENTARY ROCK Marine Fossils
IGNEOUS ROCK Galena	SEDIMENTARY ROCK Bauxite

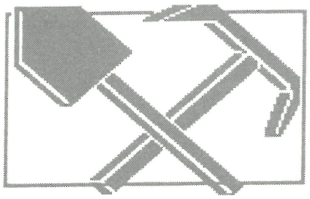
Use **Spacebar** to move to ***Core Sample***.
Press **Return**.
Use **Arrow** keys to select one quarter.
Press **Return**.

4 Get Diagrams



Use **Spacebar** to move to ***Diagrams***.
Press **Return**.
Use **Arrow** keys to select one quarter.
Press **Return**.

5 Mine



Use **Spacebar** to move to ***Mine***.
Press **Return**.
Use **Arrow** keys to select one block.
Press **Return**.

6 Get a Record

Mining Record
Resource: Oil
Amount Found: 499,000 KILOTONS
% World Known Rerserves: 14.9%

Go to the Main Menu.
Use **Spacebar** to move to ***Display Record***.
Press **Return**.

Quit

Go to the Main Menu. Use the **Spacebar** to move to ***End and Save Game or Project***.
Press **Return**.

AppleWorks

Save your work as a history file. When AppleWorks asks for the pathname, type **/geoworld/gwdata.txt**

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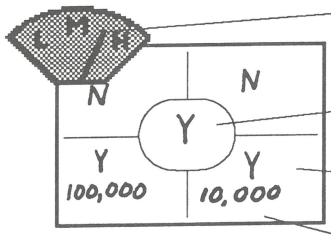
Test Recorder

How to Use the Test Recorder



Draw a line to the highest point reached in the Geochemical Test.

Did the Core Sample show evidence? Write Y or N.

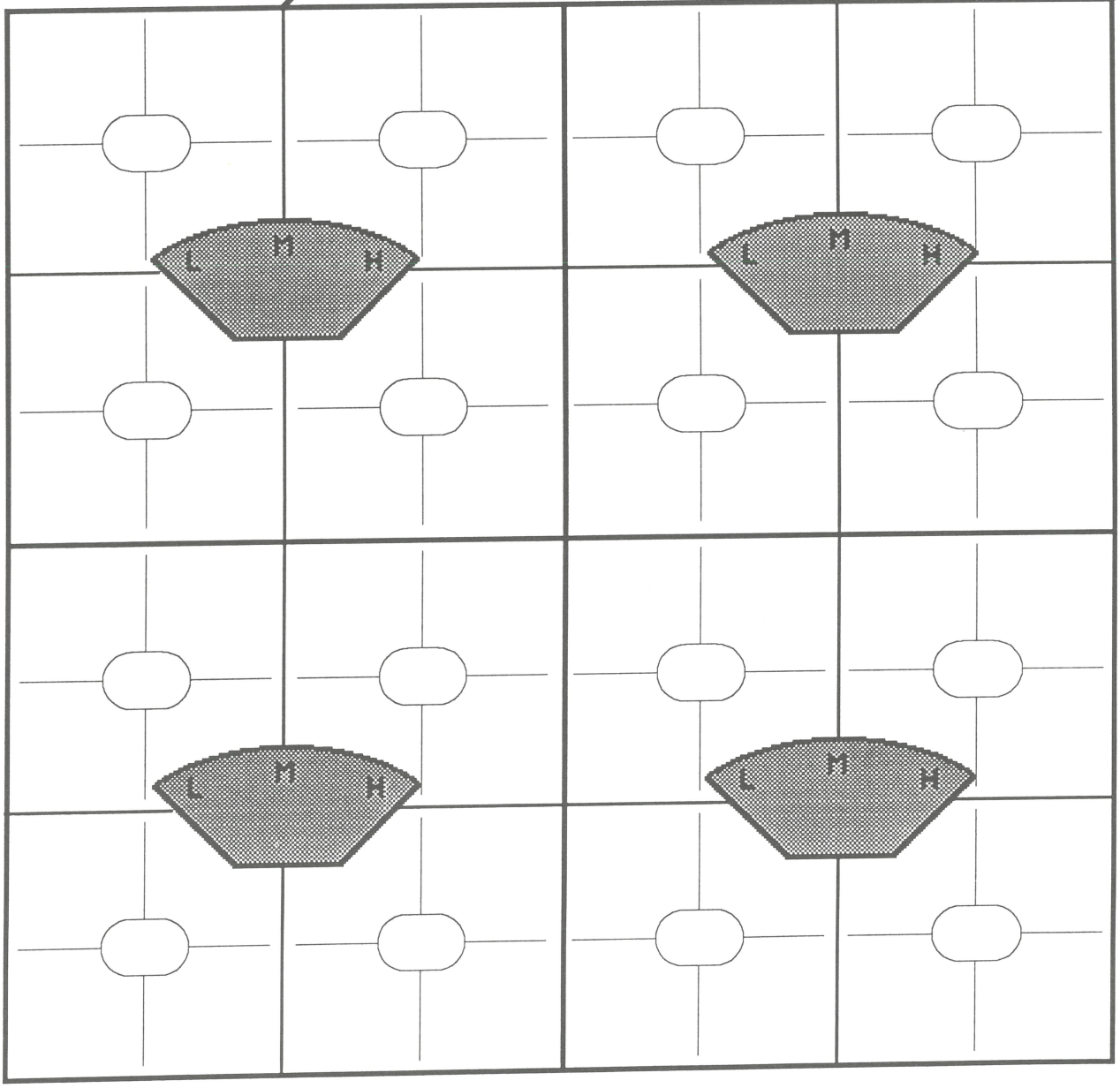
Did the Diagrams show evidence? Write Y or N.

Write how much of the resource you mined.

Long. ____

Lat. ____

Area of the World _____



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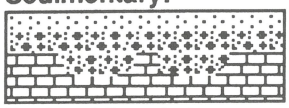
Aluminum

How to Find Aluminum (Al)

Core Sample: Look for **bauxite**.

Diagrams of Underground Cross Sections: Look for this picture.

Sedimentary:



Residual (Laterite)
Deposit

Uses: airplane construction, motor vehicles, refrigerators, and beverage cans.

List other uses for aluminum: _____

_____

Current Value in $: _____

Locations: *List the places where you found aluminum.*

Place	Amount	Place	Amount

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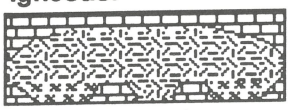
Chromium

How to Find Chromium (Cr)

Core Sample: Look for **chromite.**

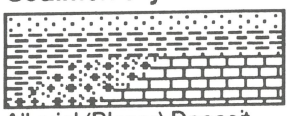
Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:



Magma Segregation Deposit

Sedimentary:



Alluvial (Placer) Deposit

Uses: used to make alloys with iron, nickel and cobalt. Chromium gives its alloys strength, toughness, hardness and resistance to oxidation, corrosion and abrasion. Chrome steel is used in cars, airplanes, and trains. Chromium is also used to make stainless steel and to plate iron, steel, copper, brass and other metals.

List other uses for chromium: _____

_____

Current Value in $: _____

Locations: *List the places where you found chromium.*

Place	Amount	Place	Amount

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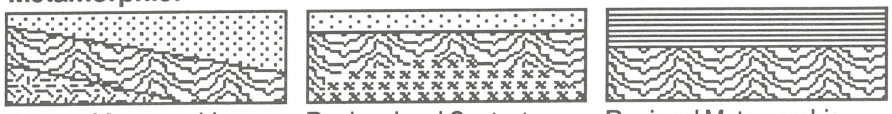
Coal

How to Find Coal

Core Sample: Look for **anthracite** and **plant fossils.**

Diagrams of Underground Cross Sections: Look for these pictures.

Metamorphic:



Contact Metamorphic Deposit

Regional and Contact Metamorphic Deposit

Regional Metamorphic Deposit

Uses: Coal can be burned to heat homes and buildings. It can heat water into steam to run factories or to manufacture electricity. Coal can also be made into gas.

List other uses for coal: _____

_____

Current Value in $: _____

Locations: *List the places where you found coal.*

Place	Amount	Place	Amount

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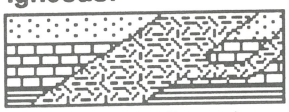
Cobalt

How to Find Cobalt (Co)

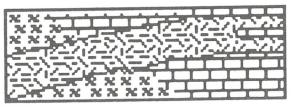
Core Sample: Look for **skutterudite**.

Diagrams of Underground Cross Sections: Look for these pictures.

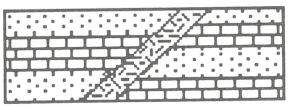
Igneous:



Magmatic Dike Deposit

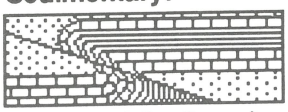


Fissure Vein Deposit

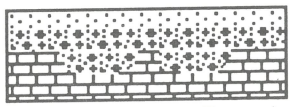


Faulted Vein Deposit

Sedimentary:



Faulted Anticline Deposit



Residual (Laterite) Deposit

Uses: Cobalt is alloyed with nickel and aluminum to form alnico which is used for powerful magnets. These magnets are used in radios, televisions and other electronic devices. Cobalt is also put into alloys used for jet engines and gas turbines because it remains hard even at temperatures up to 1,800°F.

List other uses for cobalt: _____

_____

Current Value in $: _____

Locations: *List the places where you found cobalt.*

Place	Amount	Place	Amount
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

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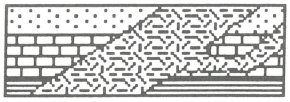
Copper

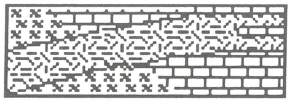
How to Find Copper (Cu)

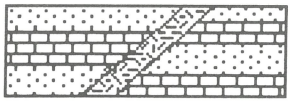
Core Sample: Look for **chalcocite.**

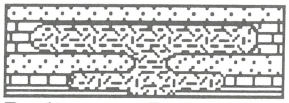
Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:

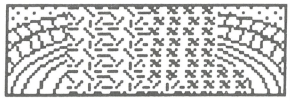

Magmatic Dike Deposit

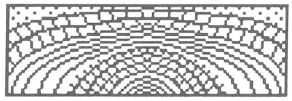

Fissure Vein Deposit

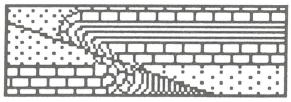

Faulted Vein Deposit


Replacement Deposit

Sedimentary:


Porphyry Deposit


Anticline Deposit


Faulted Anticline Deposit

Uses: Copper is easily shaped and molded. This metal can be made into a thin, tough wire that does not break easily, and it can be rolled into thin sheets. Copper has high electrical conductivity, and copper wires are used to carry electric currents for light, power, and telephone and telegraph systems.

List other uses for copper: _____

_____

Current Value in $: _____

Locations: *List the places where you found copper.*

Place	Amount	Place	Amount

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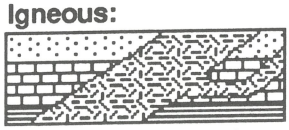
Gold

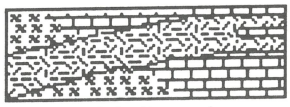
How to Find Gold (Au)

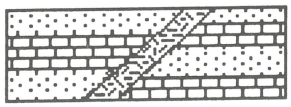
Core Sample: Look for **gold.**

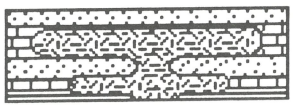
Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:

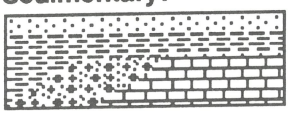

Magmatic Dike Deposit


Fissure Vein Deposit


Faulted Vein Deposit


Replacement Deposit

Sedimentary:


Alluvial (Placer) Deposit

Uses: monetary use, jewelry, electronics and gold plating.

List other uses for gold: _____

_____

Current Value in $: _____

Locations: *List the places where you found gold.*

Place	Amount	Place	Amount

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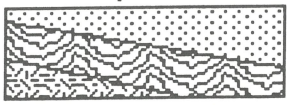
Iron

How to Find Iron (Fe)

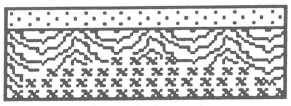
Core Sample: Look for **hematite.**

Diagrams of Underground Cross Sections: Look for these pictures.

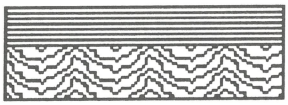
Metamorphic:



Contact Metamorphic Deposit

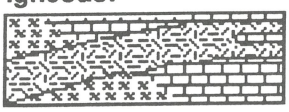


Regional and Contact Metamorphic Deposit

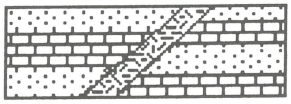


Regional Metamorphic Deposit

Igneous:

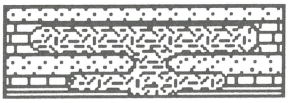


Fissure Vein Deposit



Faulted Vein Deposit

Magmatic Dike Deposit



Replacement Deposit

Uses: construction, transportation, machinery, appliances, and for making steel.

List other uses for iron: _____

_____

Current Value in $: _____

Locations: *List the places where you found iron.*

Place	Amount	Place	Amount

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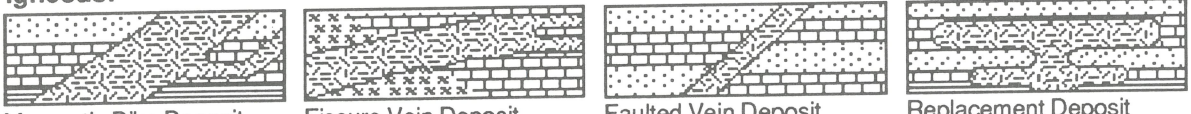
Lead

How to Find Lead (Pb)

Core Sample: Look for **galena**.
Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:



Magmatic Dike Deposit | Fissure Vein Deposit | Faulted Vein Deposit | Replacement Deposit

Uses: batteries, pipes, gas additive, and solder.
List other uses for lead: _____

_____

Current Value in $: _____

Locations: *List the places where you found lead.*

Place	Amount	Place	Amount

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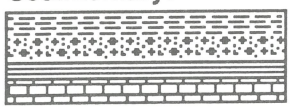
Manganese

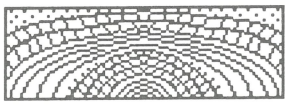
How to Find Manganese (Mn)

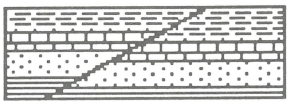
Core Sample: Look for **pyrolusite.**

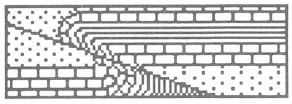
Diagrams of Underground Cross Sections: Look for the following pictures.

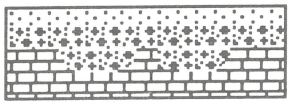
Sedimentary:


Regular Deposition Deposit


Anticline Deposit


Faulted Deposition Deposit


Faulted Anticline Deposit


Residual (Laterite) Deposit

Uses: About 95% of manganese is used for making iron and steel. It strengthens the steel and removes impurities from it. Manganese steel is used where hardness and toughness are desired -- armor plate, car wheels, railway switches, and cutting and grinding machinery.

List more uses for manganese: _____

_____

Current Value in $: _____

Locations: *List the places where you found manganese.*

Place	Amount	Place	Amount

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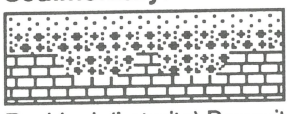
Nickel

How to Find Nickel (Ni)

Core Sample: Look for **pentlandite.**

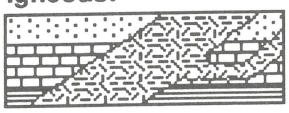
Diagrams of Underground Cross Diagrams: Look for the following pictures.

Sedimentary:

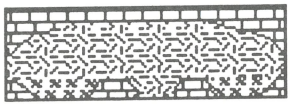


Residual (Laterite) Deposit

Igneous:



Magmatic Dike Deposit



Magma Segregation Deposit

Uses: stainless steel, making coins, and plating. Nickel is used as an alloy with steel, iron, bronze, brass,and copper because it makes the metals stronger and resistant to rusting.

*List other uses for nickel:*_____

_____

Current Value in $: _____

Locations: *List the places where you found nickel.*

Place	Amount	Place	Amount

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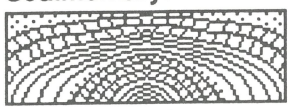
Oil

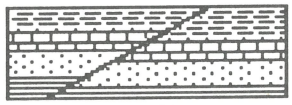
How to Find Oil

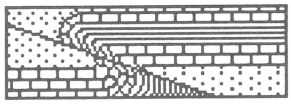
Core Samples: Look for **marine fossils.**

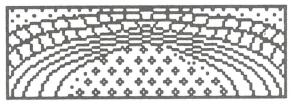
Diagrams of Underground Cross Sections: Look for the following pictures.

Sedimentary:


Anticline Deposit


Faulted Deposition Deposit


Faulted Anticline Deposit


Salt Dome Deposit

Uses: energy, kerosene, plastics, synthetic fabrics, and jet fuel.

List other uses for oil: _____

_____

_____

Current Value in $: _____

Locations: *List the places where you found oil.*

Place	Amount	Place	Amount

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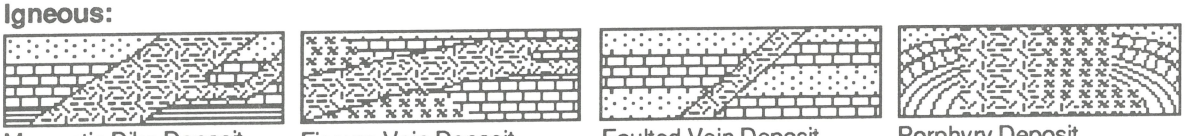
Silver

How to Find Silver (Ag)

Core Sample: Look for **argentite**.
Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:



Magmatic Dike Deposit | Fissure Vein Deposit | Faulted Vein Deposit | Porphyry Deposit

Uses: monetary uses, electrical and chemical uses, sterling and plated silverware, photographic and chemical industries.

List other uses for silver: _____

_____

_____

Current Value in $: _____

Locations: *List the places where you found silver.*

Place	Amount	Place	Amount

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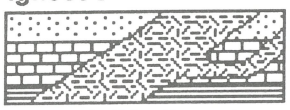
Tin

How to Find Tin (Sn)

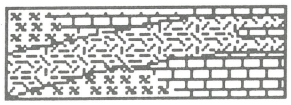
Core Sample: Look for **cassiterite.**

Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:

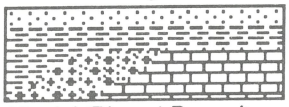


Magmatic Dike Deposit



Fissure Vein Deposit

Sedimentary:



Alluvial (Placer) Deposit

Uses: tin cans and tin plate which is used for roofing. Tin is alloyed with copper to make bronze.

List other uses for tin: _____

_____

Current Value in $: _____

Locations: *List the places where you found tin.*

Place	Amount	Place	Amount

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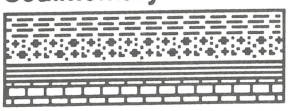
Uranium

How to Find Uranium (U)

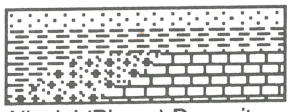
Core Sample: Look for **pitchblende.**

Diagrams of Underground Cross Sections: Look for these pictures.

Sedimentary:

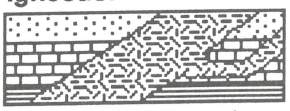


Regular Deposition Deposit

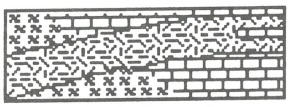


Alluvial (Placer) Deposit

Igneous:



Magmatic Dike Deposit



Fissure Vein Deposit

Uses: nuclear fuel.

List other uses for uranium: _____

_____

Current Value in $: _____

Locations: *List the places where you found uranium.*

Place	Amount	Place	Amount

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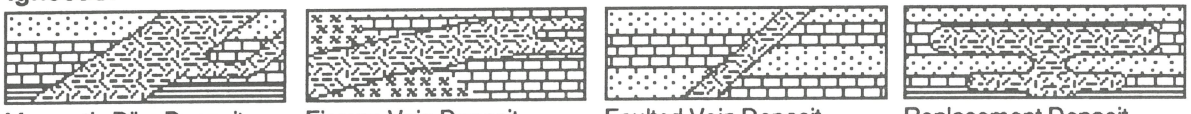
Zinc

How to Find Zinc (Zn)

Core Sample: Look for **sphalerite**.

Diagrams of Underground Cross Sections: Look for these pictures.

Igneous:



Magmatic Dike Deposit | Fissure Vein Deposit | Faulted Vein Deposit | Replacement Deposit

Uses: Zinc galvanizing is the process of coating steel with zinc to prevent rusting. Zinc is alloyed with copper to form brass. Zinc die castings are used for automobile carburetors, pumps and hub caps.

List other uses for zinc: _____

_____

_____

Current Value in $: _____

Locations: *List the places where you found zinc.*

Place	Amount	Place	Amount

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Resource Chart

Natural Resource	Element Symbol	Ore or Rock in Core Sample	Deposit Type Shown in Diagrams	Diagram Number
Aluminum	**Al**	Bauxite	Sedimentary Deposits	5
Chromium	**Cr**	Chromite	Igneous Deposits Sedimentary Deposits	11 6
Coal		Anthracite Plant Fossils	Metamorphic Deposits	14,15,16
Cobalt	**Co**	Skutterudite	Igneous Deposits Sedimentary Deposits	8,9,10 4,5
Copper	**Cu**	Chalcocite	Igneous Deposits Sedimentary Deposits	8,9,10,12,13 2,4
Gold	**Au**	Gold	Igneous Deposits Sedimentary Deposits	8,9,10,12 6
Iron	**Fe**	Hematite	Metamorphic Deposits Igneous Deposits	14,15,16 8,9,10,12
Lead	**Pb**	Galena	Igneous Deposits	8,9,10,12
Manganese	**Mn**	Pyrolusite	Sedimentary Deposits	1,2,3,4,5
Nickel	**Ni**	Pentlandite	Sedimentary Deposits Igneous Deposits	5 8,11
Oil		Marine Fossils	Sedimentary Deposits	2,3,4,7
Silver	**Ag**	Argentite	Igneous Deposits	8,9,10,13
Tin	**Sn**	Cassiterite	Igneous Deposits Sedimentary Deposits	8,9 6
Uranium	**U**	Pitchblende	Sedimentary Deposits Igneous Deposits	1,6 8,9
Zinc	**Zn**	Sphalerite	Igneous Deposits	8,9,10,12

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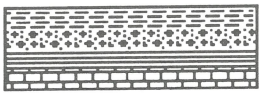
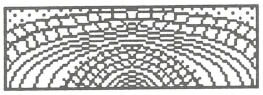
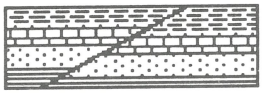
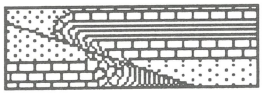
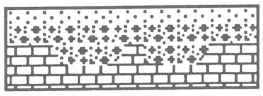
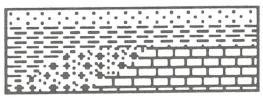
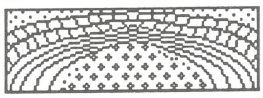
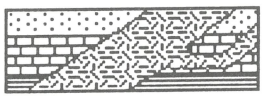
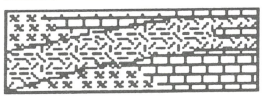
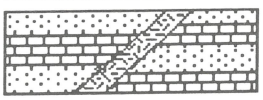
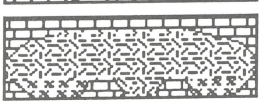
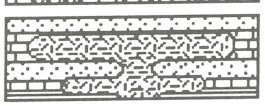
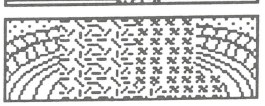
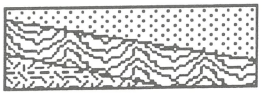
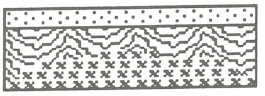
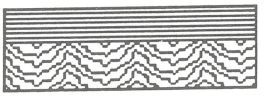
Deposit Types Chart

Deposit Type		Diagrams	Description
Sedimentary	1		Regular Deposition Deposit
	2		Anticline Deposit
	3		Faulted Deposition Deposit
	4		Faulted Anticline Deposit
	5		Residual (Laterite) Deposit
	6		Alluvial (Placer) Deposit
	7		Salt Dome Deposit
Igneous	8		Magmatic Dike Deposit
	9		Fissure Vein Deposit
	10		Faulted Vein Deposit
	11		Magma Segregation Deposit
	12		Replacement Deposit
	13		Porphyry Deposit
Metamorphic	14		Contact Metamorphic Deposit
	15		Regional and Contact Metamorphic Deposit
	16		Regional Metamorphic Deposit

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Data Base Activity Sheet

Try these activities with your data base.

1. Arrange the information so that the resource amounts are listed from smallest to largest.

2. Direct AppleWorks to display information for only the largest amounts.

3. Write down the latitude, longitude and amount of the five largest deposits. Use a map to find out which countries contain these deposits. Fill in the chart below:

Latitude	Longitude	Amount	Country

4. Direct AppleWorks to display only the smallest amounts of the resource.

5. Write down the latitude, longitude and amount of the five smallest deposits. Use a map to find out which countries contain these deposits. Fill in the chart below:

Latitude	Longitude	Amount	Country

6. Direct AppleWorks to display all the information in your data base. Arrange the Deposit Type category alphabetically. How many deposits did you find of igneous rock? _____ metamorphic rock? _____ sedimentary rock? _____

7. What is the total amount of the resource that you found? _____

8. What is the total percentage of the world's known reserves of the resource that you found? _____

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Word Processor Activity Sheet

You just started a geological company called **Rocky Roads**. Times are hard, and your company has not yet been hired to search for resources. But, in today's *Geological Times*, you saw this exciting ad.

> **Geologists wanted**
> for top-secret mission.
> Big bucks and national
> publicity will be yours!
> Send a copy of your
> best mining report.

Use the word processor to write a mining report. Follow these steps:

1. Give your report a title. For example, **Mining Report for Gold**.

2. Add commas to make the numbers easier to read. For example, change **2500** to **2,500**.

3. Change the totals (listed at the bottom of the chart) into complete sentences. For example, **I found 22,000,000 ounces of gold. This is 49.7% of the world's known reserves of gold.**

4. Write a description of your search for the resource. Where did you search? What strategies did you use?

   _____

   _____

   _____

5. Examine your findings and write a description of them.

   _____

   _____

   _____

6. Use a map to find out which countries contain the largest amounts of the resource. Add this information to your description.

   _____

   _____

   _____

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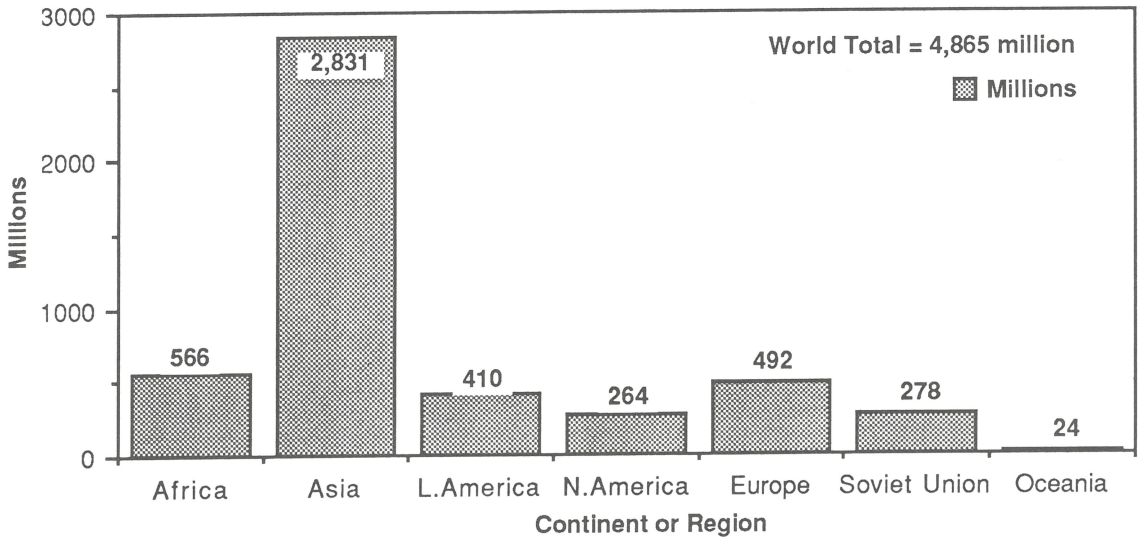
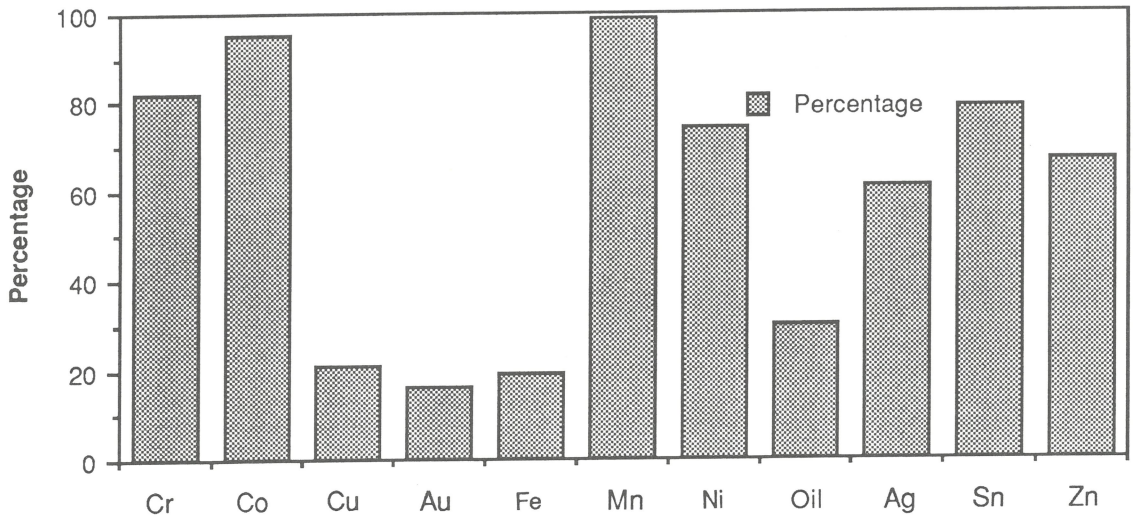
World Population for 1985



Source: U.S. Bureau of the Census, *World Population 1985.*

Natural Resources:
What percentage of what the United States uses is imported?



Source: U.S. Bureau of Mines, *Mineral Commodity Summaries*; U.S. Bureau of the Census import and export data.

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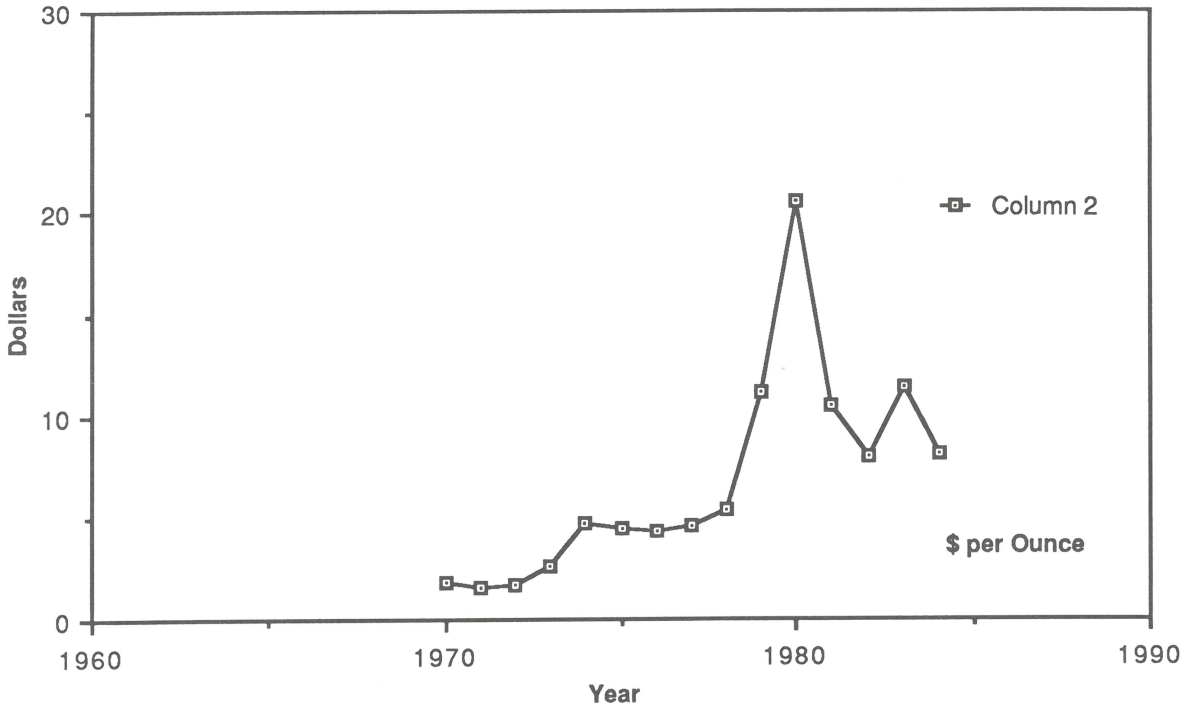
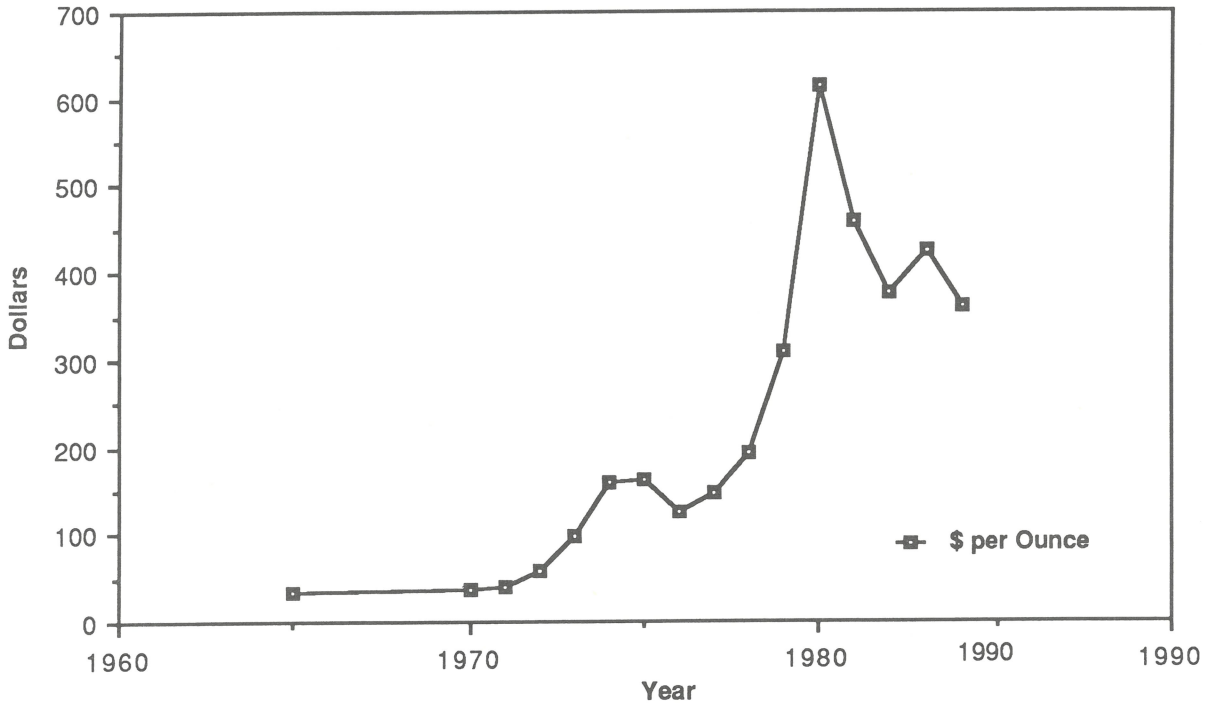
Prices of Gold and Silver

Silver: Average Prices (1970 - 1984)



Source: U.S. Bureau of Mines, *Mineral Facts and Problems.*

Gold: Average Prices (1965 - 1984)



Source: U.S. Bureau of Mines, *Mineral Facts and Problems.*

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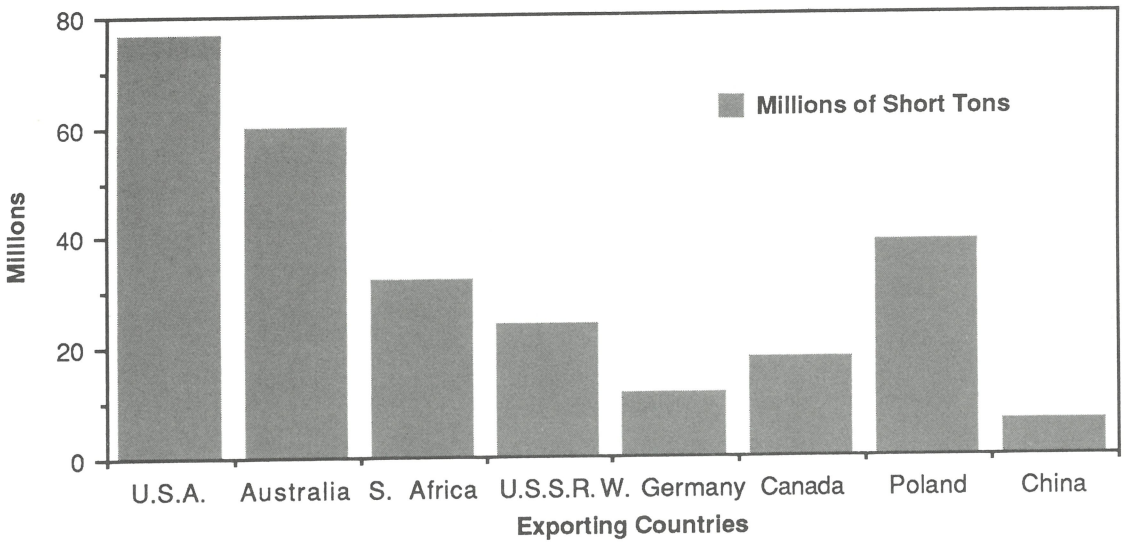
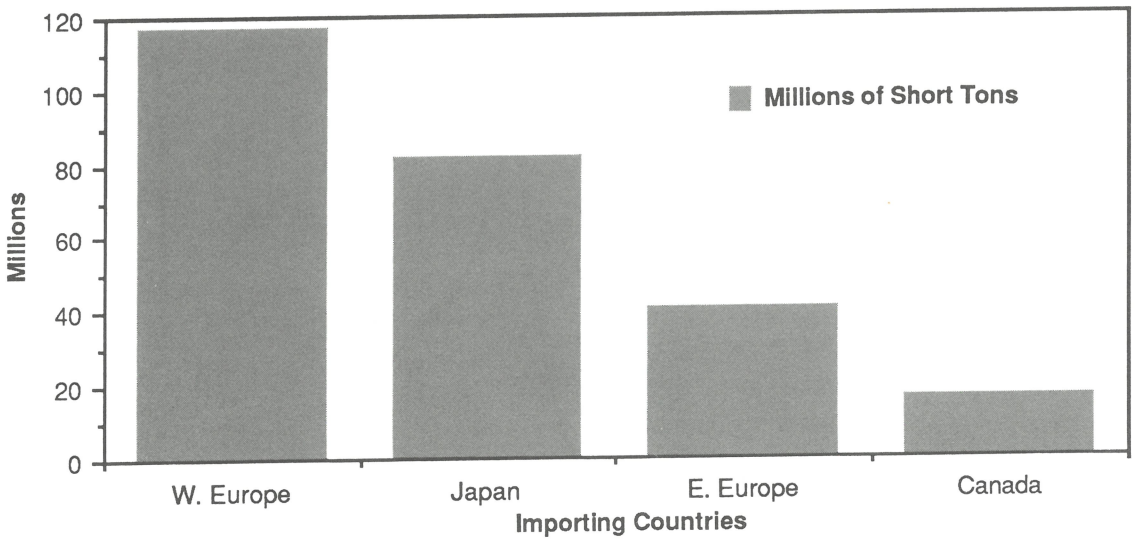
World Coal Trade

Amount of Coal Exported in 1983



Source: U.S. Energy Information Administration, *Annual Prospects for World Coal Trade 1985.*

Amount of Coal Imported in 1983



Source: U.S. Energy Information Administration, *Annual Prospects for World Coal Trade 1985.*

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Vocabulary

Alloy -- A metal that is a mixture of two or more metals or a mixture of a metal and another substance. Also, to mix metals.

Alluvial -- Soil deposited by moving water which becomes rock over time.

Anthracite -- An ore containing coal.

Anticline -- Rock layers folded upwards.

Argentite -- An ore containing silver.

Bauxite -- An ore containing aluminum.

Cassiterite -- An ore containing tin.

Chalcocite -- An ore containing copper.

Chromite -- An ore containing chromium.

Conservation -- Controlling how natural resources are used in order to save them.

Core Sample -- A geological exploration technique. Geologists drill a long narrow hole into the earth ("a core") to sample the kinds of rock below the surface. After doing many core samples, geologists are able to put together a more complete "picture" of an area's formations and deposits.

Crust -- The hard outer layer of the earth.

Dense -- Thick and closely packed.

Deposit -- A body of rock which contains a large amount of one or more minerals. Deposits are formed in many different ways. Also, to put or lay in a place.

Deposition -- Layers formed by the settling of soil, sand, or rock during erosion.

Diagrams of Underground Cross Sections -- A picture that shows the formation of rocks and ores beneath the earth's surface. Geologists perform many core samples in a small area and use this information to construct diagrams.

Dike -- A large mass of igneous rock that forms when magma cuts across rock layers and then hardens.

Dome deposit -- Deposits shaped like a dome that are formed by pressure from below.

Equator -- An imaginary line around the middle of the earth. It divides the earth into the Northern Hemisphere and the Southern Hemisphere.

Erosion -- The natural process of moving soil and rock from one place to another.

Fault -- An underground break in the earth's crust.

Fissure -- A narrow opening or crack in rock. A deposit may form there when molten material gets into that crack or opening.

Fossil -- Evidence of plants or animals that lived long ago. For example, the footprint of an extinct animal or the imprint of a leaf in a rock.

Galena -- An ore containing lead.

Geochemical Test -- A chemical test used to measure the presence of a mineral. There are many kinds of chemical tests performed on rock samples to determine whether or not a mineral is present.

Hematite -- An ore containing iron.

Igneous rock -- Rock formed from cooled lava or magma.

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Vocabulary

Imprint -- A mark made when something is pressed into a surface.

Lava -- Magma that has reached the earth's surface.

Latitude -- The distance in degrees north or south of the equator. Latitude lines are called parallels because they are parallel to the equator.

Longitude -- The distance in degrees east or west of the prime meridian. Longitude lines pass through the North and South Poles. Longitude lines are called meridians.

Magma -- Molten rock beneath the earth's surface.

Map projection -- A representation of the globe on a flat surface.

Marine -- Found in or formed by the sea.

Metamorphic rock -- Rock that has been changed by heat or pressure but has not melted.

Mine -- To take minerals out of the ground. There are many kinds of mining procedures.

Mineral -- A solid, naturally-formed substance that is found in the earth. A mineral does not contain organic materials, and its properties always stay the same.

Molten -- Something which is in liquid form because it is so hot.

Nonrenewable resource -- Resources which can be used only once, such as oil.

Ore -- A rock that contains a useful mineral and can be mined profitably. For example, bauxite is an ore from which aluminum is mined.

Pentlandite -- An ore containing nickel.

Pitchblende -- An ore containing uranium.

Pyrolusite -- An ore containing manganese.

Recycling -- The process of recovering a natural resource so it can be used again.

Renewable resource -- A resource which can be replaced or used again.

Replacement -- A hydrothermal process where rock is replaced by a hot mineral solution. The solution cools and the mineral deposit forms.

Reserve -- A supply.

Rock -- A piece of the earth's crust which is made up of one or more minerals.

Sediment -- Pieces of rock and the remains of animals or plants.

Sedimentary rock -- A rock that is made when sediments are packed together and become hard.

Skutterudite -- An ore containing cobalt.

Sphalerite -- An ore containing zinc.

Topographic map -- A map which shows the shapes and sizes of land surfaces.

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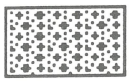
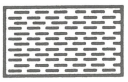
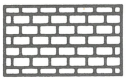
Rock Symbols

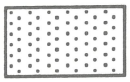
I. Geologists use the following rock symbols to draw diagrams of the way rocks are arranged underground.

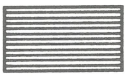
Sedimentary Rocks

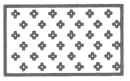
 Conglomerate

 Mudstone

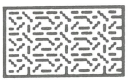
 Limestone

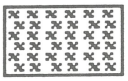
 Sandstone

 Shale

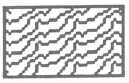
 Salt

Igneous Rocks



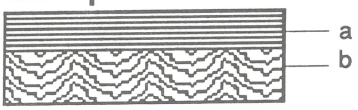


Metamorphic Rocks



II. Identify the rocks in these diagrams.

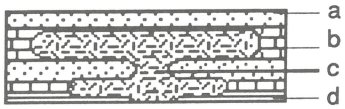
Example



a shale

b metamorphic

1.



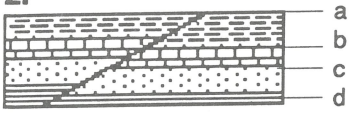
a _____

b _____

c _____

d _____

2.



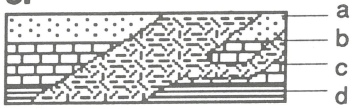
a _____

b _____

c _____

d _____

3.



a _____

b _____

c _____

d _____

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Class Record-Keeping Chart

Class: **Date:**

Student	Resource	Amount Found	%	Comments

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Resource Locations Around the World

This chart lists some countries which have large amounts of the different resources.

Resource	Countries*
Aluminum	Australia, Guinea, Jamaica, USSR, Brazil, Surinam, Yugoslavia, Hungary, Greece, Guyana, France, China, India
Coal	USA, China (PRC), USSR, E. Germany, Poland, South Africa, India, Australia, United Kingdom
Chromium	USSR, South Africa, Brazil, Turkey, the Phillipines, India, Zimbabwe, Finland
Cobalt	Zaire, Zambia, Australia, USSR, New Caledonia, Cuba, Morocco, Canada, Norway, Finland
Copper	Chile, USA, USSR, Zambia, Canada, Zaire, Poland, China, Peru, Australia, Philippines
Gold	South Africa, USSR, Canada, USA, China, Australia, the Phillipines, Papua New Guinea, Chile, Zimbabwe, Brazil
Iron	USSR, Brazil, Australia, USA, China (PRC), India, Canada, France
Lead	Australia, USA, USSR, Canada, Peru, Mexico, Yugoslavia
Manganese	USSR, South Africa, Gabon, Brazil, China (PRC), India, Australia, Mexico, Ghana, Morocco, Japan
Nickel	USSR, Canada, Australia, New Caledonia, Indonesia, Cuba, the Philippines, South Africa
Oil	USSR, Saudi Arabia, USA, Iran, Mexico, Iraq, Kuwait, Libya
Silver	Mexico, Peru, USSR, Canada, USA, Australia, Poland, Chile, Japan
Tin	Malaysia, USSR, Indonesia, Bolivia, Thailand, China (PRC), Brazil, Australia
Uranium	USA, Canada, USSR, South Africa, Australia, Niger, Nambia, France, China
Zinc	Canada, USSR, Australia, Peru, USA, Mexico, Japan, Sweden, South Africa, China

**The countries are ordered by the approximate size of their reserves from largest to smallest.*

Resource Locations in the United States

This chart lists some states which contain large amounts of each resource. The states are in alphabetical order.

Resource	States
Aluminum	Arkansas
Chromium	Nevada, Montana, Washington
Cobalt	Idaho, Pennsylvania
Coal	Illinois, Indiana, Kentucky, Montana, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wyoming
Copper	Arizona, Idaho, Montana, Missouri, New Mexico, Utah
Gold	Arizona, California, Colorado, Montana, Nevada, New Mexico, South Dakota, Utah
Iron	Michigan, Minnesota, Missouri, Nevada, Utah, Wisconsin
Lead	Arizona, Missouri, Idaho, Colorado, Utah, New York, Montana
Manganese	Minnesota, South Carolina
Nickel	Oregon
Oil	Alaska, California, Illinois, Kansas, Louisiana, Michigan, Mississippi, New Mexico, North Dakota, Oklahoma, Texas, Wyoming
Silver	Arizona, Idaho, Colorado, Missouri, Montana, Nevada, New Mexico, Utah
Tin	Alaska
Zinc	Colorado, Idaho, Missouri, New York, New Jersey, Pennsylvania, Tennessee
Uranium	Arizona, Colorado, Idaho, Nevada, New Mexico, Texas, Utah, Washington, Wyoming

Using GeoWorld with Earth Science Textbooks

GeoWorld is an excellent supplement to the earth science curriculum. This chart shows where GeoWorld fits into a number of earth science textbooks. The textbooks are listed in alphabetical order by publisher.

Textbook	Grade Levels	Chapters or Units	Topics
Cebco: *Concepts and Challenges in Earth Science,* 1986	6-9	Unit 1 pp. 10-29	Studying the Earth; Map Projections
		Unit 2 pp. 30-52	Rocks and Minerals; Identifying Minerals
		Unit 3 pp. 53-70	Classifying Rocks; Rock Formations
		Unit 12 pp. 253-266	Resources and their Uses
Holt, Rinehart & Winston: *Holt Earth Science,* 1986	7-9	Chapter 2 pp. 29-63	Map Projections; Map-Reading
		Chapter 8 pp. 213-237	Minerals
		Chapter 9 pp. 238-262	Rock Types
		Chapter 10 pp. 267-303	Resources and their Uses
Holt, Rinehart & Winston: *Modern Earth Science,* 1983	9-12	Chapter 6 pp. 116-131	Models of the Earth; Map Reading
		Chapter 8 pp. 153-181	Minerals and their Properties; Rock Types
		Chapter 18 pp. 376-381	Deposit Formations; Reading Diagrams of Underground Cross Sections

Continued on next page.

Using GeoWorld with Earth Science Textbooks

Textbook	Grade Levels	Chapters or Units	Topics
Laidlaw: *Experiences in Earth Science*, 1985	7-9	Chapter 2 pp. 32-47	Minerals and Ores
		Chapter 3 pp. 48-61	Rock Types
		Chapter 4 pp. 64-81	Map Projections; Map-Reading Skills
		Chapter 25 pp. 482-507	Resources and their Uses
Macmillan: *Earth Science*, 1986	6-9	Chapter 10 pp. 204-218	Minerals and their Properties
		Chapter 11 pp. 221-240	Rock Types
Prentice-Hall: *Earth Science*, 1986	7-9	Chapter 5 pp. 136-145	Characteristics and Uses of Minerals
		Chapter 6 pp. 156-173	Rock Types
		Chapter 8 pp. 197-215	Geologic Features; Map Reading
		Chapter 20 pp. 465-485	Resources and their Uses

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